HOUSEHOLD WATER SECURITY AND ADOPTION OF SAFE DRINKING WATER PRACTICES AMONG WOMEN WITH CHILDREN UNDER FIVE YEARS IN NAKURU MUNICIPALITY SLUMS, KENYA

By

ROSEMARY WANYOIKE

This Dissertation is submitted in Partial Fulfillment of Requirements for the Award of a Master of Development Studies of St. Paul's University

AUGUST, 2018

Household Water Security and Adoption of Safe Drinking Water Practices among Women with Children Under Five Years in Nakuru Municipality Slums, Kenya

By

Rosemary Wanyoike

This Research Proposal is submitted in Partial Fulfillment of Requirements for the Award of a Master of Development Studies of St. Paul's University

SUPERVISORS: 1. Dr. Daniel Nzengya Muasya
2. Dr. Susan Kamuru

AUGUST, 2018

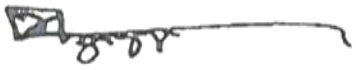
DECLARATION

This research Project is my own work and has not been previously presented to any other institution for award of a degree.

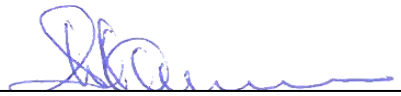
SIGNATURE OF THE STUDENT _____

DATE _____

We confirm that the work reported in this research proposal has been done by the student under our supervision.

SIGNATURE OF THE SUPERVISOR 1: 

DATE 23/8/2018

SIGNATURE OF THE SUPERVISOR 2: 

DATE 23/8/2018

DEDICATION

This dissertation is dedicated to my two families that are very dear to me: My immediate family members, and the members of the congregation of the Sisters of Mercy particularly Nakuru community for their support and encouragement throughout the course.

ACKNOWLEDGEMENT

I wish to express my gratitude to the almighty God for giving me the opportunity and the strength to go through my studies

I am grateful to my supervisors Dr. Daniel Nzengya and Dr. Susan Kamuru for their commitment, diligent guidance and encouragement during this work. Every time you made me feel that I am capable. May God bless you and grant you strength and good health that you may be able to help others who will be under your guidance.

I thank my companions in MDS class Nakuru campus for their encouragement and support throughout the course. You made uphill tasks possible.

I also thank the community of sisters of Mercy- Nakuru for their support and standing in for me when I had to take long hours studying. God bless them all.

I thank my family especially my brothers George and Samuel for their financial and moral support during this course. God bless then and grant them their deepest heart desires.

I will forever be grateful to my late parents Jane Wambui and James Wanyoike for laying a solid foundation in my education. Rest in peace mum and dad.

ABSTRACT

Sustainable development goal (SDG) number 3 calls upon the governments to "ensure healthy lives and promote well-being for all at all ages". Key strategies to realize improved healthy lives is ensuring every citizen has access to safe drinking water. Rapid urbanization continues to challenge government's efforts of ensuring total coverage in water accessibility. Recent statistics indicate that the proportion of infants and children who die from illnesses related to unsafe water in the urban centers has exceeded the rate in Kenyan rural areas. The purpose of this research was to examine water security and the level of adoption of safe drinking water practices among women with children under five years in Nakuru, Kenya. Data were collected using researcher administered questionnaires from a sample of 182 women, purposively and proportionately drawn from four settlements, namely, Manyani, Murogi, Wagamata and Nyamarutu. Measurements variables included water accessibility, water security, water safety knowledge and practices. Quantitative data were analyzed using SPSS for descriptive statistics, correlation and hierarchical regression. Qualitative data were analyzed to identify key themes. Results showed that although all the women from the four settlements had access to an improved water source, water insecurity was a pervasive problem among majority of the women, particularly those from Wagamata, Murogi, and Nyamarutu. Differences in water security across the four settlements were statistically significant, F (3,178) = 32, $p < 0.01$. Nyamarutu had the highest proportion of water insecurity followed by Murogi and Wamagata respectively. Manyani had the highest percentage respondents who had fully adopted safe drinking water practices. Regression analysis results showed that household size, ease of access to water infrastructure, distance to water source, and time taken queuing for water were predictors of water security. Water insecurity negatively affected adoption of safe drinking water practices. The study recommended that, interventions by government and /or private partners that incentivize landlords to extend water within their premises be put in place to reduce the burden of water insecurity among women with children under five years.

TABLE OF CONTENT

DECLARATION ..... **iii**
DEDICATION ..... **iv**
ACKNOWLEDGEMENT ..... **v**
ABSTRACT ..... **vi**
TABLE OF CONTENT ..... **vii**
LIST OF TABLES ..... **x**
LIST OF FIGURES ..... **xi**
LIST OF ABBREVIATIONS AND ACRONYMS ..... **xii**
CHAPTER ONE **1**
INTRODUCTION **1**
1.0 Overview of chapter 1
1.1 Background 1
1.2 Statement of the Problem 2
1.3 Purpose of the study 3
1.4 Objectives of the study 3
1.4.1 General objective 3
1.4.2 Specific objectives 3
1.5 Significance of the study 4
1.6 Scope of the study 4
1.7 Limitation of the study 4
1.8 Operational definition of terms and concepts 5
1.9. Summary of the chapter 7
CHAPTER TWO **8**
LITERATURE REVIEW **8**
2.0 Introduction 8
2.1 Empirical Review 8
2.1.1 Overview of Safe Drinking Water Practices 8
2.1.2 Interventions to improve water supply in the Urban Slums 13
2.1.4 Emerging concerns in relation to water supply interventions in urban slums 14
2.1.5 Relational approach in the design of water intervention in the slums 18
2.1.6 Gaps in knowledge identified in previous research in relation to women with children under five years 20
2.2 Theoretical Framework Informing Previous Research 20

2.2.1 Theoretical framework for this research.....22
2.3 Conceptual Framework.....26
2.4 Summary of the chapter.....27
CHAPTER THREE.....28
METHODOLOGY.....28
3.1 Introduction.....28
3.2 Research Design.....28
3.3 Area of Study.....28
3.5 Target Population.....29
3.6 Sampling Procedure and Sample Size.....30
3.7 Data collection instrument and Measurement Variables.....30
3.7.1 Reliability.....31
3.7.2 Validity of the instruments.....31
3.9 Ethical considerations.....32
3.10 Summary of the chapter.....32
CHAPTER FOUR.....33
DATA ANALYSIS, INTERPRETATION AND PRESENTATION.....33
4.1 Introduction.....33
4.2 Socio-demographic characteristics of the study sample.....33
4.2.2 Age of women.....34
4.2.3 Highest educational attainment.....34
4.2.4 Main source of income.....35
4.2.5 Household size.....35
4.2.6 House ownership.....36
4.2.7 Number of children under five years.....36
4.3 Water accessibility.....37
4.4 Water security.....43
4.4.1 Perceived safety and sufficiency of water supply.....44
4.4.2 Challenges to water access.....45
4.4.3 Social relations related to water.....47
4.4.4 Opportunity costs of water collection.....48
4.4.5 Measures used to minimize water use.....49
4.4.6 Thirst.....52
4.5 Adoption of drinking water safety practices.....54

4.5.1 Adoption of water treatment practices 54
4.5.2 Reasons for not treating water by households 55
4.5.3 Adoption of safe storage practices 57
4.5.4 Adoption of safe drinking water practices by both treatment and storage 60
4.7 Regression analysis – explanatory variables for water insecurity 61
4.8 Summary of the Chapter.....64
CHAPTER FIVE 65
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 65
5.0 Introduction 65
5.1 Socio-demographic characteristics of the sample.....65
5.2 Water accessibility and water insecurity 66
5.3 Water affordability.....67
5.4 Water security by informal settlements.....68
5.5 Adoption of safe drinking water practices – Storage and Treatment.....70
5.7 Conclusion.....71
5.8 Recommendations.....72
5.9 Suggestions for future research.....72
REFERENCES 74
APPENDICES.....77
Appendix 1: Letter of Introduction.....77
Appendix 1I: Questionnaire for mothers with children under five 78
Appendix 111: Research Authorization Letter.....83
Appendix IV: Research Permit 84

LIST OF TABLES

Table 4.2: Socio-demographic characteristics of the sample 33

Table 4.3: Water accessibility and water security 38

Table 4.4: Percentages of women who reported stress related experiences in relation to water by settlement. 53

Table 4.5: Motivations for preferring wide mouthed containers (number of times mentioned).....58

Table 4.6: Mean, standard deviations, Cronbach's Alpha and inter-correlation among key variables.....63

Table 4.7 Regression Analysis on water security 63

LIST OF FIGURES

Figure 1: Trans-theoretical model 24
Figure 2: Theory of planned behavior 25
Figure 3: Conceptual Framework 26
Figure 4: Reasons for not having large water containers 43
Figure 5: Water Insecurity Score 44
Figure 6: Water treatment methods 54
Figure 7: Reasons for not treating water in Manyanin, Murogi, Wamagata and Nyamarutu 55
Figure 8: Adoption of safe Water storage 57
Figure 9: Adoption of safe drinking water by safe storage and treatment 60

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ARV	Anti-retroviral
CBD	Central Business District
CBO	Community Based Organizations
DALYs	Disability Adjusted Life Years
G/E	Gastro-Enteritis
HIV	Human Immunodeficiency Virus
JMP	Joint Monitoring Program
KAN	Kenya African National Union
KNBS	Kenya National Bureau of Statistics
KPLC	Kenya Power and Lighting Company
MPN	Most Probable Number
NAWASSCO	Nakuru Water and Sanitation Company
NACOSTI	National Council for Science Technology and Innovation
NGO	Non-Governmental Organization
PHC	Primary Health Care
PoU	Point of Use
SD	Standard Deviation
SDG	Sustainable Development Goals
SODIS	Solar Disinfection
SPSS	Statistical Packages for Social Sciences
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSD	Water and Sanitation Program
WSP	Water Supplies Department

CHAPTER ONE

INTRODUCTION

1.0 Overview of chapter

This chapter discussed the background of the study, problem statement, general and specific objectives, research questions, significance or the justification of the study, scope of the study, limitation, and assumption of the study.

1.1 Background

Sustainable development goal (SDG) number 3 calls upon the governments to "ensure healthy lives and promote well-being for all at all ages". Key strategies to realize improved healthy lives is increasing access to improved water, sanitation and hygiene.

According to Joshi & Amadi (2013), 850 million people world-wide have poor access to water supply and 2.5 billion lack access to sanitation and in every five people globally, one practices open defecation. This way, hastened access to water, sanitation and hygiene facilities, can reduce the global burden of diseases and death rates related to water, sanitation and hygiene by 9.1% and 6.3% respectively. Diarrhoea related cases contribute to 1.9 million with new diarrhoea cases estimated at 4 billion yearly, mostly among children under five years old. WHO statistics review of 2009 revealed that the highest severe case rates due to diarrhoea incidences occurred in India where over 386,000 deaths were reported. Joshi & Amadi (2013) posit that, in Egypt death rates attributed to diarrhoea in 2013 were about 13.9% among them children under five years.

Bartram and Cairncross (2010) posit that diarrhoea diseases kill more young children than HIV/AIDS, Tuberculosis and Malaria combined. Improving hygiene, sanitation, and safe drinking water can serve as the key to containing this disease burden. They further argue that some of the long term impacts of diarrhoea diseases in early childhood contribute more to disability adjusted life years than do deaths. 2.4 million (42%) of all deaths globally can be prevented annually if all people observed safe drinking water practices, appropriate good hygiene and sanitation. Developing countries suffer highest mortality rates from diarrhoea and subsequent malnutrition.

Access to water and sanitation facilities is a basic human right. According to Vaishnavi Madhavan (2015) safe water and sanitation form some of the elements of Primary

Health Care (PHC). Safe water is expected to serve as health promotion and disease prevention intervention. This study focused on safe drinking water. Aigbiremelon et al. (2015) describes safe drinking water practices as the provision of safe adequate water. WHO and UNICEF joint monitoring program for water supply and sanitation reported that there were gains in water provision and sanitation between 1990 and 2010 (Pullan et al. 2014). However, this has only been notable at the global level but national and regional disparities remain, mostly affecting rural-urban areas.

Inadequate drinking water supply adversely affects children under five years and their mothers. Children suffer diarrhoea as a result of oral fecal contamination. They are vulnerable and die from diarrhoea. Worell et al (2013) states that, those open to prolonged exposure to fecal related pathogens including worms in early life, may suffer brain under-development, malnutrition and stunting. Consequently many do not live to see their fifth birthday.

Whereas Kenya has made remarkable progress to increase supply of safe drinking water to its citizens, efforts are being challenged by rapid population growth and urbanization. To worsen the matter, urbanization in Kenya takes the form of proliferation of informal urban settlements, where overcrowding, poor housing, and lack of planning further intensifies and constrains efforts to provide services. The proportion of infants and children who die from illnesses related to poor water, hygiene and sanitation in the urban centers has exceeded the rate of rural areas in Kenya.

1.2 Statement of the Problem

Women with children under five years living in urban slums face disproportionate burden obtaining water of sufficient quantities for domestic needs and hygiene. This is because urban slums are some of the areas with lowest water service coverage. Assessment of progress in water service coverage in Kenya's urban slums rely only on water accessibility. There have been criticisms that accessibility to improved water sources does not capture inequalities in access that result especially among the poor and vulnerable groups due to resource constraints. Water security has recently been recommended as an alternative to understanding inequalities in water service provision particularly in relation to health outcomes. Unfortunately, few studies have explored water insecurity faced by women with children under five in the urban slums in Kenya. Due to increase of diseases related to drinking of contaminated water, it would been

expected that the residents of informal settlements would be keen to adopt safe drinking water practices to reduce waterborne disease burden. However, there is limited research conducted in Nakuru Town informal settlements to determine household water security and adoption of safe drinking water practices among women with children under five years living in the slums. This study aimed to fill this gap.

1.3 Purpose of the study

The purpose of this study was to examine household water security and adoption of safe drinking water practices among women with children under five years in Nakuru municipality slums.

1.4 Objectives of the study

1.4.1 General objective

The general objective of this study was to examine the level of household water security, safety knowledge and safe drinking water practices among women with children under five years old in informal settlements in Nakuru Town.

1.4.2 Specific objectives

i. To examine water security among women with children under five years old in Nakuru Municipality slums.
ii. To investigate the level of adoption of safe drinking water practices by women with children under five years in Nakuru Municipality slums
iii. To investigate the influence of household socio-demographic characteristics and water security on the adoption of safe drinking water practices among women with children under five years who live in Nakuru Municipality slums.

1.4.3 Research Questions

i. What factors influence water security among women with children under five years who live in the informal settlements in Nakuru Municipality?
ii. What is the level of adoption of safe drinking water practices among women with children under five years in the informal settlemetns in Nakuru Municipality?
iii. What are the household socio-demographic characteristics that influence adoption of safe drinking water practices among women with children under five years who live in the informal settlements in Nakuru Municipality?

1.5 Significance of the study

828 million people worldwide live in slum conditions, 45% of them being in the global South. This number is expected to rise to 2 billion by 2020 with 85% of slum settlements in cities of Sub- Saharan Africa (Corburn & Karanja, 2016). Kenya is not exceptional and therefore designing, implementing and monitoring water security and safe drinking water interventions to improve health outcomes is critical to public health measures in improving urban population health. The findings of this research may inform policy on the design, implementation and management of health and water programs in Kenya's informal settlements. The county government of Nakuru may use the findings to improve water supply in the slums.

1.6 Scope of the study

The study was conducted in Nakuru Municipality Sub-County taking cases of four slums namely Manyani Murogi, Wamagata and Nyamarutu. The study focused on household water security and adoption of safe drinking water practices among women with children under five years. The four slums had a population of approximately 29,491 people distributed among them as follows: Nyamarutu 5000, Murogi 4000, Wamagata 800 and Manyani 19,691 (Local area chief, 2018). The economic activities ranged from small businesses to casual work in industries and domestic work for example, women washing clothes.

1.7 Limitation of the study

The respondents work for long hours, which could have made it hard for the researcher to find them at home. This was addressed by getting the respondents' contacts beforehand. The researcher contacted and made appointments with the respondents. In spite of the researcher having their contacts, some of the respondents were still not available. The researcher approached other respondents to replace those who were not available. Some of the respondents did not agree to participate in the interview for personal reasons. The researcher respected their decision and moved on to other respondents. Many respondents could not read and write. The researcher addressed this by administering the questionnaire. The researcher read the questionnaire to them and filled as they answered.

1.8 Operational definition of terms and concepts

Adoption: Choosing to take up an idea or a course of action (English Oxford Dictionaries).

Children under five years: Infants and children aged between 0-59 months.

Hand Washing: Use of running water and soap to clean hands at critical moments such as after defecation**.**

Improved water sources: Those by nature of their design and construction, have the probability to deliver safe water, accessible on premises, available when needed and free from feacal contamination. These are such as piped water, boreholes or tube wells and packaged delivered water (Shaheed, Orgill, Montgomery, Jeuland, & Brown, 2014)

Intervention: This is an action taken to solve water related problems

Microbiological water quality: this is the presence or absence of bacterial in water overall (Mason, 2014)

Mothers with children under five years: These are women rearing children under five years.

Point of use water treatment (PoU): protection of water stored at the household level in containers such as bottles, buckets and pitchers by household members (Satapathy, 2014).

Primary Health Care: Is the essential care that entails preventive, promotive, curative and rehabilitative services. It comprises of education on the prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; adequate supply of water and basic sanitation; maternal and child health care including family planning; immunization against major infectious diseases; appropriate treatment of common diseases and injuries and provision of essential drugs (Vaishnavi Madhavan, 2015)

Safe drinking water storage: Keeping drinking water in a manner that prevents recontamination, considering use of adequate containers and proper handling of the same (Subbaraman et al., 2013)

Safe water: This refers to adequate supply of good quantity and quality water free of contamination (Satapathy, 2014).

Sanitation: These are practices such as fecal disposal, garbage collection, waste water disposal having drainage and sewer systems, menstruation, bathing, post defecation cleaning and changing clothes (Hullad et al. 2015).

Slum: A term used interchangeably with informal settlement to refer to an area with insufficient access to safe water, sanitation and other infrastructure, poor structural housing, overcrowding and insecure residential status (Corban & Karanja, 2016).

Unimproved water sources: These are unprotected wells and springs and people drinking surface water collected directly from a river, dam, lake, stream or irrigation canal (JMP," 2017).

Urban Poverty: Defined in two ways namely an absolute standard based on minimum needed to sustain a healthy and at least a comfortable life and as a relative standard that is accepted in a given nation (Prüss-Ustün et al (2014).

Water accessibility: Reliable water supply that creates an ease of obtaining water (Subbaraman et al., 2013)

Water insecurity: lack of sustainable access to safe water. It is absence of water quality, quantity and reliability (Subbaraman et al, 2013).

Water safety plan: A strategy to ensure drinking water safety through risk management that entails identification of areas where potential contamination in the internal plumbing system may occur and devising appropriate control measure, from source to distribution ("WSD - Water Safety Plans," 2017)

Water security: Accessibility of adequate and quality water by all people "for an active and healthy lifestyle" (Mason, 2014a).

Waterborne Diseases: These are infections that come about as a result of ingestion of contaminated water, through a process called oral fecal contamination.

1.9. Summary of the chapter

This chapter introduced the title of the study. It also pointed out some of the key aspects that informed this study. It captured the background of the study, statement of the problem, the purpose of the study, general and specific objectives, research questions, and significance of the study, scope of the study, the limitation of the study and defined key terms in the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter discusses previously published research in the area of water security and adoption of safe drinking water practices in the slums in order to understand factors that influence the implementation and sustainability of the same. Household water security and Safe drinking water practices will be discussed at length trying to investigate reasons as to why water-borne diseases persist even in areas where interventions have been given priority particularly in the urban informal settlements. It further critiques theories that have informed previous research, reviews interventions put in place to improve supply of safe drinking water in the slums and concludes by describing the theories proposed for this research. The conceptual framework guiding empirical study of household water security and adoption of safe drinking water practices in the Nakuru municipality slums is also demonstrated.

2.1 Empirical Review

2.1.1 Overview of Safe Drinking Water Practices and Health

Safe drinking water, sanitation and hygiene (WASH) remain essential elements in bringing health close to the people. They bridge the gap between wholeness and illness. Water acts as a link between sanitation and hygiene. People rely on water to drink, clean the utensils, bath and keep the environment clean. Without this, people would be prone to waterborne diseases.

To ensure water accessibility for all, safe drinking water has been recognized as a human right. As such it has been made one of the global development goals and a focus in vision 2030. Sustainable development goal number six asks governments to ensure availability and sustainability management of water for all. Similarly, vision 2030 hope to achieve regular and equitable access to safe water for all, one of the targets being access to safe and affordable drinking water. This captures what can be termed as water security. Water security entails reliable, adequate, quality and accessibility of water by all for an active and healthy life style (Mason, 2014). Lack of one attribute makes water less secure. Therefore, the effectiveness of the available infrastructure can be judged by its delivery of service level outcomes.

There have been remarkable developments in access to improved water sources. UN reports that 2.6 billion people have gained access to improved drinking water since 1990. However, 663 million are still without (UN - Water, 2018). Water scarcity affects 40% of global population. Children under five years are most affected. UN (2018) also reports that nearly 1000 children die daily from preventable water and sanitation related illnesses. It would be expected that, with improved water access, adverse impact from water borne disease would go down, but this is not the case. More efforts are needed to increase household access to improved water sources (Tuyet-Hanh et al., 2016).

Health care for under-fives is becoming a global concern. Their health seems to have an impact on development and therefore many governments are doing anything possible to ensure the same is met. For example in Kenya the beyond Zero campaign started by the First Lady Margaret Kenyatta is an indication that it is being taken seriously in Kenya. This move was widely supported including by the UN (Muhindi, 2018). It targets children's health before they are born to the time they are five years. Accessibility to consistent supply of quantity safe water is associated with positive health outcomes. Satapathy (2014) posits that intermittent water supply alongside poor sanitation and hygiene pose higher health risks.

According to Pruss et al (2014), in the 1990s, safe drinking water, sanitation and hygiene related problems accounted for 5.3% of all deaths where fecal oral diseases amounted to a large disease burden. Earlier on, estimation of disease burden revealed that diseases related to water, sanitation and hygiene caused more disabilities than deaths. There were estimated 26 deaths and 5,856 cases of disability adjusted life years reported in 2002 global estimation of disease burden (Pruss et. al. 2002). This situation affects families and particularly women with children under five years costing them time and money as well as causing emotional stress.

Many people living in the slums suffer more disease burden than their counterparts in non-slum areas. For example in 2011, Corban and Karanja (2016) state that, mortality rate from diarrhoea diseases in non-slum areas was found to be 62 per 1000 births and 151 per 1000 births in slum areas. An estimated 33% of the children under five years in Nairobi slums had reported diarrhoea while other city areas had reported less than one in five. This could be a reflection of a problem in relation to water supply and adoption

of safe drinking water practices. This study would be helpful in evaluating whether the same problem is faced by mothers with children in Nakuru Town.

Efforts to make water accessible to all have been made by Governments and Non-Governmental organizations all over the world. However, they are being challenged by rapid urbanization. Water sources have variously been classified by different researchers for example Satapathy (2014) describes them in terms of within premises referring to water inside the house, away to mean within 100 metres from the household and far to suggest 100 or more metres from the household. Correspondingly, Worrel et al (2016) states two major sources of water as improved source and un-improved water sources. Main source of water in the urban slums are improved sources including tap water and boreholes tapped inside the house, tap to compound or outside the premises and sourcing from water vendors. Long distance from the house to the water source can limit the amount of water they can collect in a day. So in many instances they may not be able to meet the amount for other household needs and at the same time spare any to be treated for drinking. Drinking water safety then is overshadowed by other demands for water.

Even when people have an improved water source, water can be contaminated at various points including source, distribution and household levels (Subbaraman, 2013) Therefore it is not to be taken for granted that water from an improved source is always safe. Its handling from the time of collection to the time it is consumed can undermine its quality. Thus people need to adopt safe drinking water practices including using clean and narrow mouthed containers and treating drinking water. This can minimize chances of water contamination and consequently reduce diarrhoea diseases in children under five years.

While one would expect slums to have poor connection to water everywhere, this is not always the case. For example in India, Satapathy (2014) reported that urban slum households had better access to tap water (74%) than non-slum areas. However, intermittent water supply alongside poor sanitation and hygiene pose high health risks. This means that laying down pipes does not justify the water quality. Many places especially in developing countries are known to have pipes connected but are dry most times. Some have been reported to have average duration of 3.3 hours and the highest

being 18 hours (Satapathy, 2014). Inadequate water supply renders drinking water unsafe and increases chances of diarrhoea infections in children under five years.

Bain et al (2014) posits that water contamination is wide spread in lower and middle income countries. This affects all types of water sources including piped water, tube well, rivers and water stored in the household. 1.8 billion People globally use a source of water with fecal contamination and therefore exposed to diarrhoea diseases through drinking water. This indicates that water insecurity is a prevalent problem and therefore a constant threat to health particularly to children under five years. While slum households do not choose to be water secure, something can be done to enable households to maintain safe drinking water practices.

Although Pullan et al. (2014), captured WHO and UNICEF joint monitoring program reporting that there were gains in water provision and sanitation between 1990 and 2010, Clansen et. al. (2014) argue that the disease burden seems to have been underestimated. In 2012, 842,000 deaths from diarrhoea were reported accounting for 15% of deaths world-wide, inclusive of 361,000 deaths of children under five years. Studies have reported that diarrhoea kills 1.5 million children from low and middle income countries (O'Reilly et al., 2012). It is the second leading cause of death in children under five years. A study done in Western Kenya by O'Reilly et al. (2012) revealed that out of 1,146 hospitalized children, 107 of them died from diarrhoea germs. These are just those who came to the hospital, there could be more who go unreported. Diarrhoea increases risk of death in under-fives. Child sickness is a great burden on financial and emotional aspects of a family and affects household, local and national development. For instance in Mathare, research has revealed that each diarrhoea episode costs on average 9.5-11.5% of monthly expenditures (Corban & Karanja, 2016).

Diarrhoea diseases are bad health outcomes associated with poor adoption of safe drinking water practices and hygiene. They are to a good extent preventable.

Bain et al. (2014) captures the WHO and UNICEF report of 2012 stating that, in developing countries, an estimated 1.9 billion people used either unimproved sources of water or improved sources with fecal contamination. The regions mainly affected by water, sanitation and hygiene issues are Africa and South East Asia. They also suffer the lowest coverage of both improved water and sanitation. This hinders the

achievement and sustainability of access to safe drinking water. Addressing safe drinking water practices can reduce the cost of living as well as improve the quality of life for the people living in informal settlements.

A combination of water insecurity and socio-demographic characteristics can influence adoption of safe drinking water practices. According Satapathy (2014), to be effective, water supply has to be of right quantity, quality, and consistency. However this has not been the case, for example in India extensive water connections have not solved the water problems fully. There still lacks the consistency in water supply. When water is not enough, other competing household needs are given priority at the expense of safe drinking water practices such as acquiring safe storage and treatment.

Discrepancy between the water connection coverage and the quality of water provided indicates lack of consideration of the unforeseen factors that undermine the quality of water. For instance, besides supply of treated water, there lacks steadiness of supply. Irregular water supply during non-supply hours according to Satapathy (2014) reduces the pressure in the pipes. Empty taps suck water that has been leaking through the faulty joints or holes and it is probably polluted by such factors as waste water seeping from the toilets, septic tanks, and domestic drains. Some of these factors are out of households' control. This is dependent on the water utilities and the governments. As a result the households are exposed to diarrhoea diseases particularly in children under five years.

Policies can contribute to water insecurity and consequently poor adoption of safe drinking water practices. For instance, Subbaraman et al (2013) points out that due to their non-recognized state, the non-notified slums are denied water services. Most of these household do not reach the World Health Organization (WHO) recommended amount of 50 litres per capita per day. They have to pay a monthly base amount of 2.73 to 7.27 US Dollars (USD) to water vendors which amounts to between 52 – 206 times more than those with legal water access depending on the season. Therefore, those in non-notified slums experience inequity where water supply is concerned. This predisposes the households to diarrhoea diseases because water is likely to be contaminated.

Subbaraman et al (2013) claims that water is contaminated and there are many incidents of water contamination in the non-notified slums than in notified slums. This

can be explained by the fact that, people start sourcing water from informal connections that are not safe. Satapathy (2014) emphasizes that, to make drinking water safe, available and accessible, to the urban poor, a public health action involving individual's behavioral change is required. This is to be done alongside laying pipes for water supply. As far as behavior change is concerned, Nizame et al (2013) indicates that many people do not use any method of water purification before consumption. Adults, however, boil water when making beverages such as coffee or tea. There seems to be an assumption that clean water is safe for drinking hence many people do not take any measure to improve it before drinking. This as a result poses health risks.

Water storage also plays a role in influencing adoption of safe drinking water. Subbaraman et al (2013) contends that storing water in wide mouthed containers contributes to the water contamination at the point of use. Majority of people store water in cooking pots, pitcher, jug bottles and pots. This creates chances of contamination as children can put objects and dip hands into the water.

2.1.2 Interventions to improve water supply in the Urban Slums

Various interventions to address water problem have been put in place. They range from digging tube wells to putting up water kiosks. According to Satapathy (2014), in India, there was increased water connection and supply in the slums. The findings on access to tap water showed that slum households had better access to tap water than non-slum urban households. There were those with access on the premises, near estimated at 100 metres from the household and far which was more than 100 metres. This shows that efforts are being made to bring water close to the people and has helped increase the quantity of water supplied. This could be one of the measures that account for the observed decline in diarrhoea diseases among children under five years.

In some places the government has helped install water in the settlements in the notified slums (Subbaraman et al. 2013). These slums are considered as having residential tenure and access to water, electricity, and sanitation. On the other hand people in non-notified slums have resulted to an informal system of water procurement from water vendors, distribution, and storage as an alternative to public water supply. Water from informal supply is often not safe for drinking. This is a clear example of inequity in water supply among the slum residents. Those in non-identified slums pay more for water because at times they source water from the vendors which is more expensive

than those who have it in the compound. Inadequate water supply, and high cost may not enable people to afford water treatment and safe storage containers and as a result consume water that is contaminated. This could be one of the reasons that have made it hard to fight diarrhoea diseases in children under five years in spite of the interventions.

According to Water Sanitation Program (2014), another intervention has been dug wells where the households pay for water from the owner. These are common water sources in Papua New Guinea for household water. Due to water scarcity, most households store water in the houses. Some store drinking water in cooking pots, pitchers, and jug bottles (Zahanggir Alam, Alinur Rahman, & Abdullah Al Firoz, 2013). This is typical of the informal settlements especially where water supply is not consistent. Some forms of water storage undermines the supply of improved water sources. Storing water in cooking pots makes it more likely to be contaminated by children as they can easily dip hands into the pot and contaminate water as they have wide mouths.

Ownership of water source also determines the access and reliability of water. Alam et al (2013) states that, some water sources are jointly owned by households and others singly owned. Ownership of the water source helps in the maintenance of the same as people take responsibility for managing their own. In this way, they can ensure regular supply of water in the house and enhance safe drinking water practices.

Another intervention is the construction of sanitation blocks that are combined with water points for sale (Simiyu (2016). This offers a forum for the residents to have a legal water connection creating a sense of citizenship. This has facilitated formal water supply, access system as well as alternatives to water problems such as underground water storage, hand pumps, reservoirs, shared taps and management of water points. Such an initiative would be expected to supply safe water for drinking and at the same time help improve hygiene consequently reducing diarrhoea incidents among children under five years.

2.1.4 Emerging concerns in relation to water supply interventions in urban slums

Previous studies have sought to address gaps in water supply in urban slums. There has been concern about reasons for the persistence of water-borne diseases despite widespread connections of the water systems (Satapathy, 2014). There is the concern to

provide quantity, quality and reliable water concurrently. This will provide safe water to many households and as a result help reduce diarrhoea diseases.

There is need to examine the existing water supply status. This calls for monitoring and evaluation of water services' management so as to ensure sustainability of the safe drinking water services (WSP, 2014). There were times water connections have been installed and there is no follow up. This can result to water system breakdown that is not identified in time. It can be costly to repair huge damage which could have been prevented in the first place. Those lapses of water supply leave the citizens without safe water for drinking as pipes get contaminated during the non-supply time. Households then use contaminated water leading to challenge of combating diarrhoea diseases.

The other concern as suggested by Corbun & Karanja (2016) is about giving water interventions a relational approach. This entails taking into consideration related factors that affect the provision of safe water. These include physical planning, process, partnership, power, policy and place and how they can be integrated into safe water interventions. Focusing on one aspect sometimes works against the achievement of sustainable water supply. It calls for integrating all the possible aspect that are thought to hinder continuous supply of adequate safe water.

There are also concerns about the prevalence of water contamination at different points between the source and the point of use. Two points of water contamination have been identified including the point of the source and at the point of use (Satapathy, 2014). WSP (2014) findings reveal that dug wells are polluted from toilet run off by flooding in the rainy season. Water contamination also varies with seasons for example in India the water is highest contaminated during the monsoon (Subbaraman et al. 2013). The point of source and the point of use are affected. The point of use is most contaminated. This creates an awareness to consider prevention of water contamination during implementation of water projects. Two things have to be considered here, the role of the government regarding safe drinking water for instance treatment at the point of source. Correspondingly, the households also have to handle water well at the point of use. As a result water pollution will decrease and increase positive health outcomes.

The size of the household slum population also has an effect on water supply. For instance, WSP (2014) posits that, due to overcrowding in the slums, some households have an approximate household size of 8.4 people, a household ranging from 1 to over

30 people implying that shared water points may serve large numbers of people. This has been the case also in Kenya. In Nairobi, it has been reported by (Corburn & Karanja, 2016) that many people have to share one water point. This makes the time spent collecting water long because of the long queues.

Water affordability is also a concern. Water in the urban areas is obtained at a cost (Subbaraman et al. 2013). Households have to make hard decisions between paying for water and making it safe and meeting other household needs at the expense of water safety. Reasonable enough, to prevent diarrhoea diseases, the settlers are willing to pay for better water services especially per household connection with a metre. This however is not yet prevalent, many people are still doing nothing to make water safe making it hard to fight diarrhoea diseases.

Perception about drinking water has also had its influence on people's safe drinking water practice. For example, a study by Alam et al (2013) revealed that water from a tube well was considered safe for drinking (64%) and few people (31%) perceived tap water safe and least of them considered boiled water safe (1%). This is a faulty assumption that clean water is safe. There are cases as mentioned earlier where water is contaminated at the source. This is especially where the water is intermittent and also during seasonal variations when water is likely to be contaminated. This perception as a result hinders people from taking precaution concerning drinking water safety leading to increased diarrhoea incidents particularly in children under five years.

Waterborne diseases might persist in the slums in spite of the water intervention measures for many reasons. Lack of awareness on the suitable types of water storage facilities may cause the persistence of waterborne diseases. Most of the households store drinking water in wide mouthed containers where the chances of contamination are high due to handling. Others who do not wash the water containers daily or after emptying the water storage container and this serves as an avenue for pathogens entry. It also serves as an entry for diarrhoea diseases (Joshi et al, 2013).

Subbaraman et al (2013) explains that poverty is a barrier to water affordability by the poorest people. They cannot afford to pay for services on repaid basis for instance in the Water Aid programs. They have to make spending choices making them use any other source of water including informal connections which are sold at a reasonable

price but is contaminated by sewerage. This increases chances of contracting diarrhoea diseases.

Some households had tube wells for their source of drinking water and they perceived it safe for drinking. Pipe water was also considered safe and very few boiled their water for drinking (Alarm et al 2013). The queues and the long distances that people have to make and travel respectively to access water can be discouraging and this way, people do not get enough household water. On the other hand, big families have a higher demand for water and the supply at times does not meet the demand of each family (WSP, 2014). Since water treatment is an additional cost, many may opt to meet other needs and abandon the same. Consequently they may consume water that is contaminated resulting in diarrhoea among children under five since their immunity is low.

The challenges highlighted by these researchers negatively affect women with children under five years more than mothers who do not have children that age. These women are tasked with caring for the sick members of the family, having to be out of the work a fact that Corbun & Karanja (2016) explain reduces the home maker productivity. Diarrhoea diseases put the children at multiple risks such as vitamin A and mineral deficiencies, malnutrition and retarded growth. Prolonged exposure to fecal related pathogens as well as worms in early life affects brain development and lowers sustained immunity and consequently poor performance in school. Diarrhoea leads to high mortality rate mainly in children under five years (Subbaraman et al, 2013).

Where the cost of water is concerned, the mothers may not have enough money to provide for the family's other needs such as food. Absenteeism from work, medical expenses and cost of prevention such as water treatment, fuel for boiling water among other costs, lead to the marginalization of the mothers with children under five years and have to depend on other people (Corban & Karanja, 2016).

Gender factor comes in where though women have a big role in WASH matters, they seem to have little say when it comes to making decisions. These decisions as stated by WSP, (2014) that have to do with installation of water source and the location of the same. There seems to lack representation in decision making forums pertaining water matters. This complicates their efforts in improving water, sanitation and hygiene. Mothers remain helpless in the face of increased diarrhoea diseases.

According to Hulland et al (2015) inadequate access to water and sanitation is linked to psychosocial stress in women. In severe cases where a child dies, the mother gets stressed. Similarly, after disconnection the water from the pipes is dirty making its quality to be doubted; such times drinking water is avoided for fear of children suffering diarrhoea. Domestic violence and conflict can occur due to water scarcity (WSP, 2014). Women collecting water at night also risk physical and sexual abuse. Shared bills result in disputes. These affect women as they are the ones who mainly fetch water. Child's sickness also takes most of the women's attention.

2.1.5 Relational approach in the design of water intervention in the slums

Increase in urban informal settlements remains a challenge for health promotion. Corbun & Karanja, (2016) state that: "Only a relational place-based characterization of informal settlements can accurately capture the forces contributing to existing urban health inequities and inform appropriate and effective health promotion and intervention". This demands exploration of related characteristics at play in water supply and health inequities and the remedy required. Corbun & Karanja, (2016) identify three key interrelated variables namely, the forces, health inequities and health promotion interventions. How these factors interact determines health outcomes. They propose a place based intervention in responding to WASH related challenges. This is an all rounded approach that focuses on more than one aspect.

There are a number of forces as mentioned by Corbun and Karanja (2016) including policy, physical planning, partnerships, power, place, and process that can be considered when planning water interventions. Other factors can be context specific because population groups are not static. Health promotion inequities include water scarcity and contamination, poor drainage, child morbidity and mortality, from diarrhoea diseases among other concerns. The forces determine the nature of intervention required at a given time.

Policy, one of the characteristics, entails guidelines on many things that happen in the settlements, for example, Satapathy (2014) points out that, the settlements that are on the government land are non-recognized. This means that they are not supplied with services such as water, electricity, and security.

Physical planning concerns building and infrastructure that facilitates the services to be accessed without much difficulty. According to Nizame et al (2013), Physical planning

may be made difficult due to lack of space, leading to failure of considering women when planning and resultant limited facilities such as water connected to house or tapped water to compound. The policies governing planning will determine where the structures are built and the type of structures that can be built for example water supplies through water infrastructure technologies such as piped household connections. Partnerships include collaboration with different stakeholders. According to Johannessen et al., (2014) these may include the government, households, community and public- private partnerships. Each stakeholder contributes uniquely.

Power is about influence. It is helpful to identify the people who have influence in the community. They can help in influencing policy formation or change. They also act as champions in interventions. The place offers the context in which the intervention is to take place and each community is unique. The process involves how things are done. This suggests how the intervention is working. It gives room for bench marking, monitoring, and evaluation. This approach is holistic and sustainable. Once adopted it can take care of the water problems encountered by women and children. It will also create a sense of ownership by the community through participation.

There are various challenges that different actors might encounter using the relational framework to design and implement water intervention in the slums. Granted the relationship among the different factors, the challenges are proportional to the forces that contribute to the health inequities. Some of them include but not restricted to; at the planning level, lack of slums recognition and security of tenure may inhibit the actors especially in decision making (Satapathy (2014). There is no construction allowed in some areas. As noted by Corbun & Karanja, (2016), the residents are always in fear of eviction hindering the construction of permanent structures. That means even water connection cannot be laid. This causes water insecurity and affects adoption of safe drinking water with resultant increased diarrhoea diseases.

Sometimes, the well written policies are not implemented. According to WSP, (2014), the governments fail to provide affordable and appropriate services in settlements to improve health and living conditions. Sometimes there are power struggles where different groups try to prove their supremacy. Other times the local leaders feel threatened and obstruct any developments to be implemented by other groups. Where

partnerships are concerned, it can be hard to come to a consensus and this frustrates the relational approach.

The economic factor is another challenge. Most of the groups working in these slums rely on donor funding and some of the people they help are poor. Poverty as Simiyu, (2016) captures it, threatens the sustainability of the projects as the communities are not able to refund where installation of the projects are based on cost-sharing. Similarly, people are not able to use the facilities fully. For instance, the water for sale may not obtain full utilization as households may opt to look for alternative sources of water such as informal water connection tapped from major pipes. Implementing an integrated approach in water intervention may be challenged as Satapathy, (2014) reveals by intermittent water supply in spite of widespread water connection. Contamination of water at various points and informal water sources that supply water regularly may contaminate. This poses health risks in children under five years.

2.1.6 Gaps in knowledge identified in previous research in relation to women with children under five years

There is concern that despite increased water connection in some of the slums, there is still persistence of water related problems especially diarrhoea among children under five years. Simiyu (2016) states that some residents find water expensive where it is on pay as you use basis. So the poor families may opt not to do much to make water safe in order to meet other competing needs. This calls for the need to investigate how this problem can be tackled.

Knowledge has been a challenge hence, the need to know how much of safe drinking water awareness people have and see the patterns in gastrointestinal infection and where the problem arises from. According to Joshi et al, (2013), this applies mainly to where there are high incidents of water contamination. Corbun & Karanja, (2016) posit that children are vulnerable and contaminated water acts as a good entry point for diarrhoea diseases. Therefore sustainable intervention needs to be sought.

2.2 Theoretical Framework Informing Previous Research

Some of the theories that have informed previous research in safe drinking water practices include Health Belief Model (HBM), Trans-theoretical model, and Theory of Planned Behavior. These are basically health promotion theories. They all focus on

health behavior which entails activities taken by a person who believes himself to be healthy in order to prevent diseases or detecting diseases before the symptoms manifest (Rosenstock, Strecher, & Becker, 1988).

Health Belief Model

This model was proposed in the 1950's by a group of social psychologists at the United State (US) public service. They argued that behavior depends generally on two things including value placed by an individual on a particular goal and individual's estimate of likelihood that a given action will achieve goal. It will help in making it understood why individuals and women with children under five years do not engage in adoption of safe drinking water practices in spite of the interventions made in improving water security.

It involves five stages namely perceived susceptibility, referring to the fact that if women feel that their children are susceptible to diarrhoea diseases they may want to do something to avoid sickness and the stress associated with it. Similarly, if the mothers perceived how severe the diarrhoea diseases are to their children and entire family, they will also be stimulated to perform the proposed behavior in order to keep their children from being sick since diarrhoea is preventable. Perceived barriers can be an obstacle if the mothers felt that they cannot do anything to prevent diseases. However if they identified them and are willing to adopt the safe drinking water practices, then they will take it up. Perceived benefits will also motivate the mothers to adopt the behavior. When the diseases are prevented the mothers will think of other things that are productive for example a whole day's work that will raise the household income, healthy child and save money to do other projects.

Studies have found that if the mothers have a high level of perceived susceptibility and perceived severity the force or energy to act and perceived benefits can offer a preferred path of action. To sustain the behavior mothers may require a stimulus. It is necessary to obtain cues to action for instance mass media, interpersonal interaction, and reminder postcards from health care providers. This theory offers an approach that can help the study to examine the factors that affect uptake of a new behavior and its sustenance (Janz & Becker, 1984). This can also inform government and non-governmental agencies who implement water and health programs in their decision making.

Trans-theoretical model

This theory had five stages namely pre-contemplation, contemplation, preparation, action, and maintenance. It was proposed by Diclemente and Prochaska in the 1970s. It works in a cyclic manner and addresses the unique stage of the problem. There being more than one factor being addressed in safe drinking water practices, it would be good to assess all the related issues and the level at which the community is. This will help to address specific water related challenges. It will also aid in allocating resources and tasks. The community and individual households could have different needs and the same principle applies (Prochaska & Velicer, 1997).

The theory of planned behavior

The theory of planned behavior proposed by Ajzen in 1985 has been used in improved WASH practices promotion. It helps predict public health safety. It predicts social and health behaviors. Besides the attitudes that encourage behavior change or otherwise, the subjective norm has a communal aspect to it and determines whether the community will adopt the proposed behavior or not. In planning safe drinking water projects, it is important to assess the general perception of the community towards the new behaviors for their approval. Failure to this, the behavior might not be adopted especially if they do not take the matters seriously. One of the previous studies found that normative beliefs had greatest influence on people's intention to implement safety behavior. Also normative behavior and subjective norms were most influential factors of people's safety behavior (Javadi, Kadkhodaee, Yaghoubi, Maroufi, & Shams, 2013).

2.2.1 Theoretical framework for this research

The research drew ideas from two theories, namely, the Trans-Theoretical Model and the Theory of Planned Behaviour to explore factors that influence adoption of safe drinking water practices among women with children under five years in the urban slums of Nakuru Town.

The Trans-theoretical (stages of change model)

This model was developed by Prochaska and Diclemente in the late 1970s. They argued that willingness or intent to change behavior varies among people and within an individual and over time (Prochaska & Velicer, 1997). It focuses on decision making of the individual and is a model of intentional change. They claim that health behavior entails progress through six stages namely; (i) pre-contemplation, no intention of taking

action, for example diarrhoea diseases in children under five persists, while one might think mothers may do something to reduce the episodes, some of them do not do anything and the problem worsens. This study will explore reasons why this is so.

(ii) The next stage is contemplation. This would apply to mothers who are planning to change in the next six months. They are more aware of the advantages and disadvantages of changing. Balancing the cost and benefits of change can lead to pessimism and people can be stuck here a state called behavioral procrastination. This can imply to the cost of connecting water to compound compared to buying water on demand from vendors. Some mothers might be scared by the price of connecting and decide not to have piped water. yet, piped water might offer more water security compared to buying it on demand (Prochaska & Velicer, 1997).

(iii) Preparation: this is the stage in which people are intending to take action in the immediate future measured in the next six months. This stage refers to those who are already doing something in the last six months. For example due to water insecurity, there are mothers intending to pay more for water in order to prevent their children from diarrhoea diseases by connecting water or buying packed delivered water. others could have started attending public health education class (Prochaska & Velicer, 1997). They are already doing something.

(iv) Action stage: people have made observable modifications in their lifestyles within the last six months. For example, in water insecure slums, mothers could be buying containers for water storage that are big but narrow mouthed or have spigots to ensure adequate water supply and safe drinking water for the household.

(v) Maintenance: People are working to prevent relapses or going back to the old habits. For example, mothers devising ways of storing large amounts of drinking water safely as a way of reducing the cost of boiling water regularly deemed expensive. This has to go on for 5 – 6 years (Prochaska & Velicer, 1997). It helps them to become less tempted and increasingly more confident that they can sustain the change.

(vi)There may be a relapse. Where mothers may go back to pre-contemplation or contemplation. This theory will help inform what interventions could be done to make changes in people's behavior to be sustained.

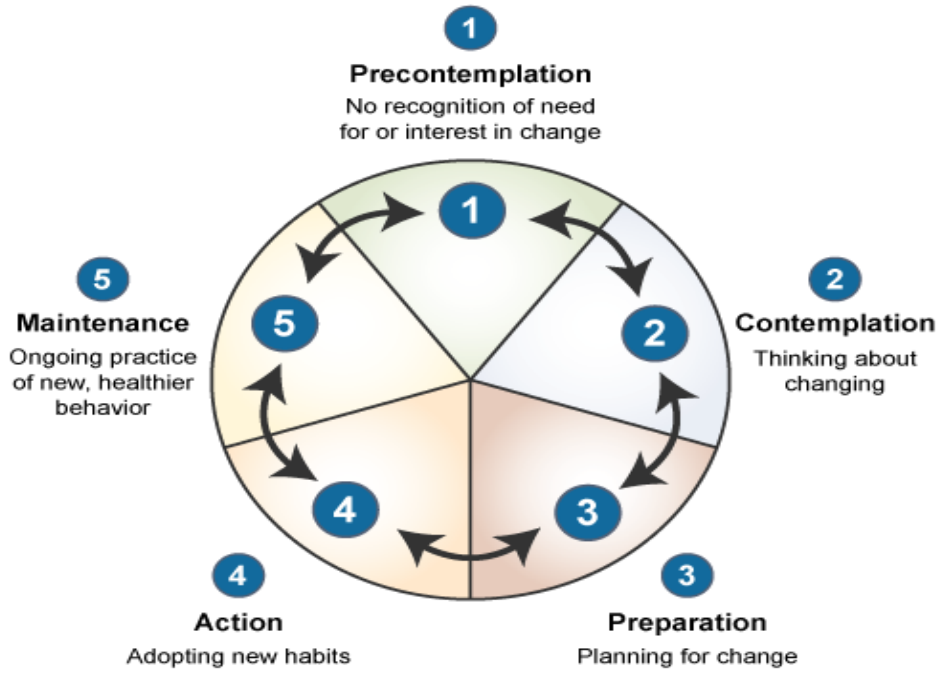


Figure 1: Trans-theoretical model
Source: adapted from Prochaska & DiClemente, 1982)

Theory of Planned Behavior

This theory predicts a person's health behavior by the attitude they have towards performing it. It was proposed by Ajzen in 1985 (Javadi et al., 2013). He added the perceived behavior control predictor to behavioral intention, attitude and subjective norm. The control predictor accounts for the times people do not have conscious control over their actions and when they intend to carry out the behavior but do not lose confidence or control.

The theory emphasizes the role of intention and suggests that the likelihood of behavior change is dependent on the control a person has over a certain behavior and the strength of the intent to change. Intention to perform a behavior is anticipated due to a person's attitude towards it and the subjective norms concerning the same. The attitude that the mothers of under-fives have towards safe drinking water will determine whether they adopt the relevant practices or not. Positive attitude and positive subjective norms produce greater perceived control and increase in behavior. When the attitude is positive, women with children under five years will apply what they learn about safe drinking water practices. Subjective norm is another component that can enhance or hinder adoption of safe drinking water practices. People living in the same community

have a lot of influence over each other. If the behavior is acceptable to the community then it will take effect. Perceived behavioral control is also considered. This has to do with the factors that hinder or facilitate the adoption of the behavior for example water treatment and safe water storage.

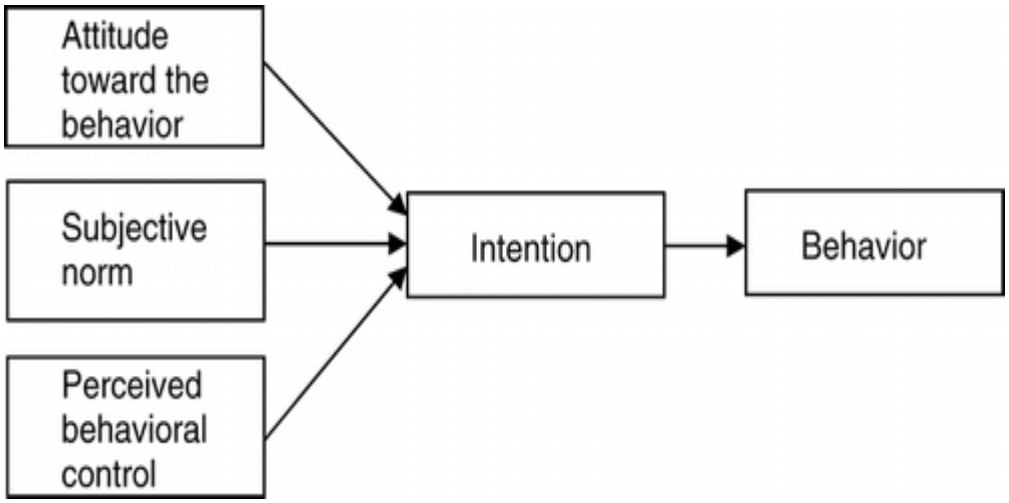


Figure 2: Theory of planned behavior

Source: (Albarracín, Johnson, Fishbein, & Muellerleile, 2001)

2.3 Conceptual Framework

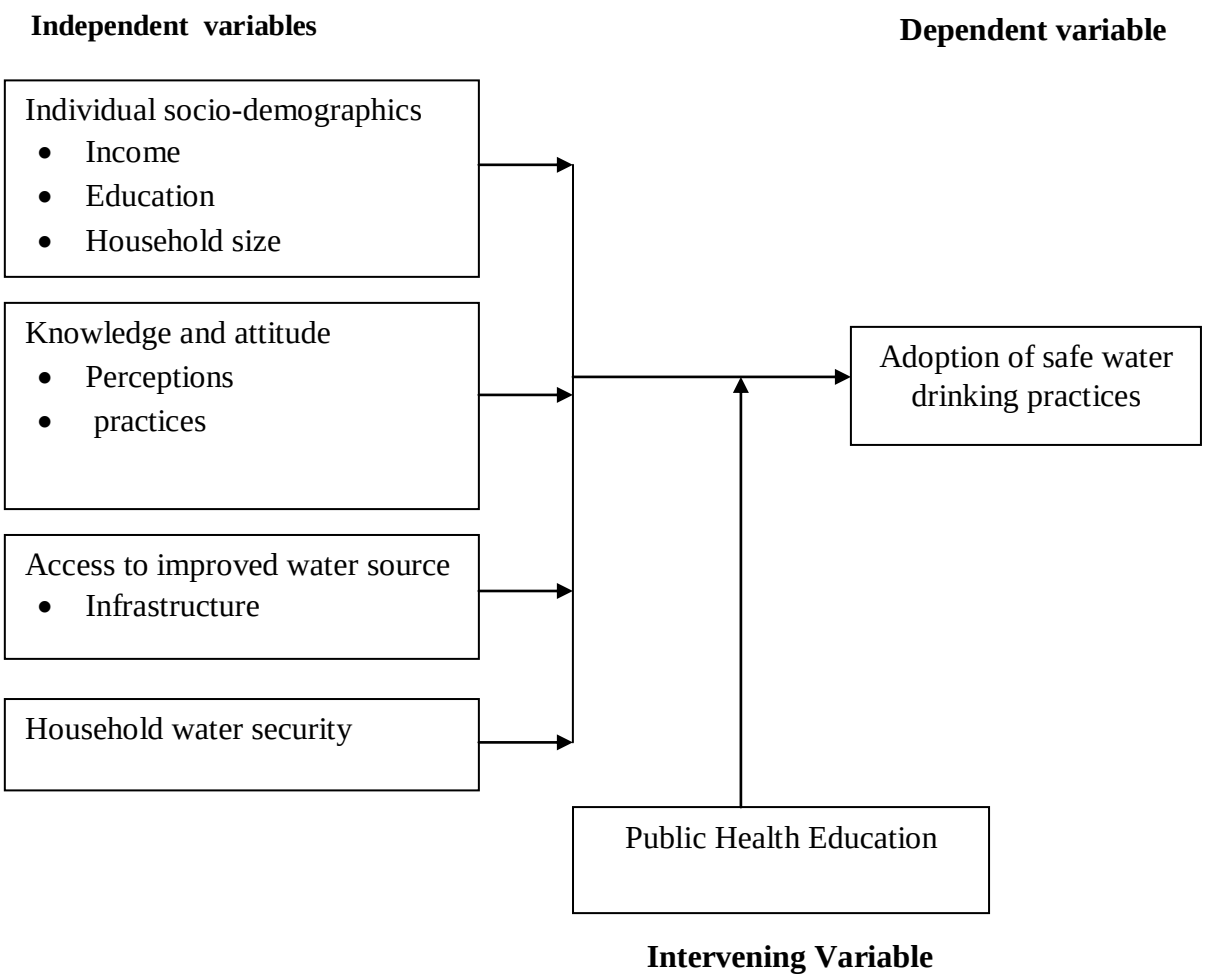


Figure 3: Conceptual Framework

Source: Author, 2018

Water security has an effect on adoption and sustainability of safe drinking practices. Many factors determine water security and consequently influence safe drinking water practices. Household size determines water security. The higher the household size the more likely the demand for water, the higher the cost of the same and as a result making it difficult to afford safe drinking water practices including treatment and safe storage.

Water may be available but then people may not observe safe drinking practices. This can be influenced by the knowledge, perception and attitudes that they have towards safe drinking water practices. On the other hand, access to improved water source determines water security and consequently safe drinking water practices. When water is not available people tend to pay attention to looking for the same at the expense of its treatment and safe storage. Similarly, long distances and long queues discourage the

mothers and they may not care about water safety. Public health education can act as a link between water security and safe drinking water practices. When mothers have adequate education on water safety including treatment, storage and handling, then it is likely that the level of adoption will go high and the diarrhoea infections related to drinking contaminated water can be reduced.

Water affordability also determines household water security. Water being for sale in town, means spending a big amount of family's income on water. This implies that families that are poor alongside other factors have to make hard decisions concerning water. There are many competing needs that overshadow water safety. All these factors when put in to consideration in urban informal settlement planning will enhance safe drinking water practices among women with children under five years. Putting in place measures that will raise levels of water security accompanied with public health education can help improve the level of safe drinking water practices among women with children under five years and resultantly reduce the incidents of diarrhoea diseases in children under five years.

2.4 Summary of the chapter

Safe drinking water is a key factor in ensuring improved health care. However, water insecurity may derail the achievement of high levels of adoption of safe drinking water among women with children under five years. To achieve this, many factors must work together. The provision of safe drinking water leads to improved sanitation and hygiene in the care of children under five years. This in turn will go a long way in turning around the disease burden and overall development of the households, counties, and country at large. Adoption of safe water drinking is assumed to be determined by factors such as water security, household socio-demographic characteristics, knowledge and attitudes. Public health education, proper planning and good policies can facilitate reliable sources of drinking water, ease of access to the same, reliability and affordability. Respectively, less disease burden can improve household socio-economic status and that will enable people to afford and sustain safe drinking water practices.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents procedures that were applied in conducting the study. These are the research design, the area of study, target population, sampling frame and size, data collection instrument and measurement variables. Pilot testing, data analysis for quantitative and qualitative data and ethical consideration are also detailed in this chapter.

3.2 Research Design

The study adopted the descriptive study design. This design seeks to provide an in-depth and accurate description of the phenomenon. The data was corrected at one point in time (Mugenda & Mugenda, 2003). The researcher conducted descriptive survey to evaluate the level of household water security, level of adoption of safe drinking water practices and the influence of socio-demographic characteristics and water security on adoption of safe drinking water practices among women with children under five years in four slums in Nakuru municipality. This helped obtain relevant and adequate information in a short time.

3.3 Area of Study

Nakuru Municipality was chosen as the area of study taking four informal settlements namely Nyamarutu, Wamagata, Murogi and Manyani. Manyani is most recent, it was established in 1998. It is in Kivumbini Sub-location, Kivumbini Ward. Nyamarutu and Wamagata are in Menengai Sub-location, Menengai Ward. Murogi is in Free Area Sub-location, Nakuru East Ward. Murogi, Wamagata and Nyamarutu settlements are in Free Area Location and have existed since 1965.

Nyamarutu was initially owned by a lady called Wanjiru wa KANU. It was a ghetto so when she died the land was sub-divided by the government into plots of 40x80 between two people. After sometime, the government recognized this settlement. This area has an estimated population of 5000 people. There have been attempts to evict these people from this place (Interview with Local area Chief on 26/10/2017).

Wamagata was started by a man called Wamagata who owned almost 800 acres of land. He was a dairy farmer. Later he sold the plots to the teachers and then sub-divided

the remaining land to the People who were working for him. This slum has a dispute where some people claim its ownership. The owners have no certificates. This slum has 15 plots of 80x40. This plot is headed by a lady. There are estimated 800 people.

Murogi slum was owned by a European man called Nelyan. Later the land was bought by Lanet housing company and sub-divided into plots. The people living there were squatters who worked for this man. There are facilities such as schools up to secondary school level and a public health Centre nearby. Garbage is collected for some of the households and a few of them have piped water. The population is estimated to be 4,000 people (Interview with Local area Chief on 26/10/2017).

Manyani slum was land that had been reserved for a public cemetery but people built up rental houses. Most of the residents are tenants. The slum has an estimated population of 19,691 people. Their main source of water is pipe water connected to house and compound (Public health officer, Nakuru, January, 2018).

The current status of Nyamarutu and Wamagata slums is that many of the dwellers have access to electricity. They are recognized by the government although they have not been able to pay for their title deeds due to financial constraints. They do not have a sewer connection to the households. Their water sources are tap water on pay as you use basis from those who own water kiosks. They dig latrines for themselves; they are not connected to a water system and garbage collection is not evenly distributed.

3.4 Measurement Variables

Measurement variables were individual socio-demographic characteristics, knowledge and attitudes and practice, household water accessibility, and access to improved water source.

3.5 Target Population

Mugenda & Mugenda (2003) defines target population as the most narrow, defined and manageable population. The target population in the study was all women with children under five years old in Nakuru municipality slums. Accessible population was women with children under five years in the four study slums.

3.6 Sampling Procedure and Sample Size

The sampling frame was women with children under five years in the four study slums. However, the population was not known and therefore the following formula was used to estimate the sample size (Mugenda and Mugenda (2003).

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

Where:

n= the required sample size,

Z= Standard deviation at a required level of confidence (1.96)

p=proportion of the target population estimated to have characteristics measured (50%)

q= 1-p

d= level of statistical significance (0.05)

If there is no estimate available of the proportion in the target population assumed to have the characteristics of interest, then 50% is recommended. That is, if the proportion of a target population with the characteristics is 0.5, the z-statistics is 1.96 and the accuracy level desired is 0.05. Then the sample size n was calculated as:

$$\mathbf{n} = \frac{1.96^2 (0.5) * (0.5)}{0.05^2}$$

n= 384. Nevertheless due to limitation of resources, this sample size was scaled down to 182 and proportionately drawn from all the four selected slums, with 53 from Manyani, 53 from Murogi, 16 from Wamagata and 60 from Nyamarutu.

3.7 Data collection instrument and Measurement Variables

Researcher administered semi structured questionnaire, and observation schedule were used to collect data. This method ensured a high response rate and the right respondent answered the questions; the answers are respondents' own words (Kothari, 2014). Data collected using questionnaires included socio-demographic characteristics, water accessibility, security and adoption of safe drinking water practices.

Semi-structured observation was adopted. According to Kothari (2004), this is direct observation without asking from respondents. Advantages of observation include that the subjective bias is eliminated if done accurately, information obtained relates to what is happening and is not complicated by past behavior or future intentions or attitudes. This was used to verify factors including water storage methods, water connection and sources.

3.7.1 Reliability

The researcher conducted a pilot study in Home Centre Slum in Nakuru municipality on 20 women with children under five years before the actual data collection to check for reliability and validity. The respondents and results of the pilot study were not part of the respondents and final findings.

Results from the pilot study were used to calculate the degree of internal consistency of the instrument in producing results or data after repeated trials, using cronbach alpha (α) coefficient of at least 0.7. This is the set minimum for social research (Mugenda & Mugenda, 2003). A cronbach coefficient of 0.79 was obtained, which is above the minimum level.

3.7.2 Validity of the instruments

The feedback from Supervisors, faculty and experiences from pilot testing brought out the weaknesses in face and content validity of the data collecting instruments. Collections were done accordingly to enhance validity.

3.8 Data analysis

After the questionnaires were collected and screened for any discrepancies, data were coded and edited to ensure their comprehensiveness and accuracy. Quantitative data were analyzed using Statistical Package for Social Science (SPSS) version 20 program. Descriptive statistics used included frequencies, percentages, means range, and standard deviation. Inferential statistics included correlation and hierarchical regression. The output was presented in the form of graphs and tables that are easy to interpret.

Content analysis was applied to qualitative data to identify key themes and frequency of patterns. Qualitative data from the questionnaire and observation were summarized and reported in narratives. The findings were presented using tables.

3.9 Ethical considerations

According to Mugenda (2003), findings, as well as guarantee of privacy and confidentiality forms inevitable consideration in any social science research. Also, procedure for obtaining ethical approval need to be followed when they apply (Gilbert, 2008). Therefore the researcher got the University clearance letter from the postgraduate directorate, the NACOSTI letter, and the letter of clearance from the local administration.

The process sought voluntary participation from all sampled respondents. The researcher introduced self to the respondents by mentioning name, the topic of the study, purpose and the institution under which the research was being carried out. The respondents participating in the survey were asked to voluntarily consent to answering questions. The researcher was very careful not to coerce or humiliate the respondents. Respondents were also assured of anonymity and confidentiality both at the beginning and the end of the survey. This was to be made possible by the researcher through providing own contact, should they feel like this promise was not honored. For security purposes, the researcher carried with her, the research clearance letters from the relevant authorities to guarantee participants that she is a legitimate researcher.

3.10 Summary of the chapter

Chapter provides the methodology used to conduct the study. Quantitative and qualitative data were collected from the descriptive study. Target population was clearly defined. Sampling procedures are outlined. The tools that were used in the study are clearly indicated. Data collection procedure, analysis and reporting are well outlined. Issues regarding validity and ethics were addressed as well.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND PRESENTATION

4.1 Introduction

This chapter presents the quantitative and qualitative data obtained from a field study carried out from four informal settlements in Nakuru Town among women with children under five years. It concerned household water security and adoption of safe drinking water practices. The study's three specific objectives included; to examine water security, to investigate the level of adoption of safe drinking water practices and to evaluate the influence of household socio-demographic characteristics and water insecurity on the adoption of safe drinking water practices. The findings are presented in graphs and tables.

4.2 Socio-demographic characteristics of the study sample

The socio-demographic characteristics of the study sample are summarized in table 4.2

Table 4.2: Socio-demographic characteristics of the sample

Variable	Category	Manyani % (M±SD)	Murogi %(M±SD)	Wamagata % (M±SD)	Nyamarutu % (M±SD)
Marital status	Married	92.5 %	92.5 %	68.8 %	60 %
Age (mean ± SD, range)	Age	27.3 ± 5.24 (18 – 46)	31.7± 10 (18 – 56)	31.9±8.53 (20-50)	27.3 ± 5.24 (18 – 54)
Highest educational attainment	Mainly Primary or no formal schooling	47.2 %	45.3%	56.2 %	68.3 %
	Mainly secondary	37.7 %	47.2 %	31.2 %	26.7 %
	Mainly tertiary	15.1 %	7.5 %	12.5 %	5 %
Main sources of income	Formal	7.5%	0.0 %	12.5 %	8.3 %
	Informal	50.9 %	34 %	62.5 %	53.3 %
	Dependent	41.5 %	66 %	25 %	38.3 %
Household size (mean ± SD, range)		4.34 ± 1.29 (2 – 8)	4.55±1.62 (2-10)	5.00±2.29 (2 – 10)	5.12 ±1.89 (2 – 11)
House ownership	Own	1.9 %	5.7 %	43.8 %	48.3 %
	Rent	98.1%	94.3%	56.2%	51.7%
Number of children under five (mean ± SD, range)		1.17±0.38 (1-2)	1.47±1.05 (1-8)	1.50±1.26 (1-6)	1.31±0.76 (1-3)

N = 53 Manyani, N = 53 Murogi N= 16 Wamagata N= 60 Nyamarutu:
Source: Survey Data (2018)

4.2.1 Marital status

Majority of the women were married. Manyani and Murogi had the highest number of participants who were married followed by Wamagata, and Nyamarutu as summarized in table 4.2. While high marriage pattern could be associated with water security, it is not the case in this study. Murogi which is high in marriage pattern has a slight difference from Nyamarutu which had lowest marriage pattern in terms of water insecurity scores. Murogi had a mean of 14.15 and SD = 6.15 while Nyamarutu had a mean of 14.93 and SD = 7.12 of water insecurity score. However the two have a big difference in full adoption of safe drinking water where Murogi had 34% and Nyamarutu had 26.7%. This implies that marital status may not be an influencing factor where water security is concerned. There could be other factors influencing water security.

4.2.2 Age of women

Most of the women were relatively young. Their ages ranged between 18 and 56 yrs. Manyani and Nyamarutu had respondents with much younger age with a mean of 27: SD = 5.24 followed by Murogi (M=31.7: SD=9.95) and Wamagata (M=31.9: SD=8.53). Age of the mother does not seem to be a major factor influencing water security. This is because Manyani which is water secure has similar age mean and standard deviation as Nyamarutu which has highest water insecurity score. However they have a huge difference in percentages of adoption of safe drinking water practices 37.7% and 26.7% respectively. So there could be other reasons attributed to water security.

4.2.3 Highest educational attainment

Manyani had the highest percentage of women with tertiary education (15.1%) while Nyamarutu had the highest percentage of respondents with the lowest educational level. 68.3% of women from Nyamarutu had mainly primary education and below. While Manyani had highest level of full adoption compared to the other three slums, education attainment does not seem to justify water security. It would be expected in this study that Wamagata which had a narrow margin in tertiary education (12.1%) with Manyani (15.1%) would be water secure or rather the difference in water security would not be so wide. Manyani had a mean of 4.5 and a standard deviation (SD) of

5.45 while Wamagata had a mean of 11.06 and SD = 4.14. Therefore, education by itself may not be a major influence in water security. However it could be an influencing factor in adoption of safe drinking water practices. From the findings, Manyani and Murogi where the education levels are high have higher levels of adoption of safe drinking water practices. So water security coupled with a high level of education can influence safe drinking water practices.

4.2.4 Main source of income

As shown in the conceptual frame work, adoption of safe drinking water practices and its sustainability are associated with water affordability. Participants were asked about their sources of income that they relied on. Wamagata had the highest percentage of women on formal employment (12.5%) and the highest number of women on informal employment (62.5%) and lowest on those who were dependent (25%). It seems that source of income had an impact on water security and subsequent adoption of safe drinking water practices. Manyani which had a balanced composition of sources of income had highest water security score compared to other settlements. Reliable source of income contributes to water security and as a result raises the level of adoption of safe drinking practices. The households can afford to buy water, afford treatment and safe storage facilities. Similarly, this lowers the incidences of diarrhoea diseases among children under five years.

4.2.5 Household size

The researcher inquired the number of people per household across the four settlements. The number of people per household ranged between 2 and 11 people. Manyani had the smallest household sizes with a mean of 4.34 and SD = 1.29. Nyamarutu had the highest number of people per household with a mean of 5.12: SD=1.89. Household size seems to have a bearing on water security and ultimately adoption of safe drinking water practices. The demand for drinking water rises with the number of people per household. At the same time, safe drinking water practices come at a cost. So where water is for sale accompanied by large household size, it may be hard to sustain big amount of water in the house and spare any to treat for drinking.

Some methods of water treatment for example boiling, are expensive. This implies that households may not manage to buy water and treat it concurrently. The women have to consider the price of water, treatment, safe storage and the maintenance of the

treatment. With many of them being on informal employment, this may not be sustainable where the household size is big since they need a large amount of water that has to be treated all the time. So water could only be treated when there is any money left. As a result of not treating drinking water, the households are exposed to diarrhoea diseases affecting mostly the children under five years because they are vulnerable and have low immunity.

The mean household size is consistent with what is expected of the standard of living. Many poor households tend to have a big number of people, a fact that is in agreement with the Kenya National Bureau of Statistics (Mbugua, 2018) findings recently released. Wamagata and Nyamarutu which had been ranked very poor and extremely poor respectively have higher number of people per household compared to Manyani and Murogi which are better.

4.2.6 House ownership

Women were asked about the ownership of the houses they lived in. Manyani had the highest number of respondents living in rented houses (98.1%) while Nyamarutu had highest percentage of those who owned houses (48.3%). It would be expected that those owning houses would be water secure. They would be considered to be saving on rent and would therefore be able to afford water and practice safe drinking water practices. Surprisingly, this is not the case in this survey. Manyani had lowest water insecurity score with a mean of 4.5 and SD = 5.45 while Nyamarutu had highest water insecurity score with a mean of 14.93 and SD = 7.12. Correspondingly, Manyani had the highest percentage of women who had fully adopted safe drinking water practices (37.7%) much higher than Nyamarutu (26.7%). Therefore house ownership may not be a major influence in water security and adoption of safe drinking water practices. This implies that there could be other factors influencing water security and the resultant adoption of safe drinking water practices.

4.2.7 Number of children under five years

Women were asked for the number of children in the household. The number of children per household in all settlements ranged between 1 and 8. Manyani had the least number of children under five years per household with a mean of 1.17 and SD = 0.38. Wamagata had highest number of children under five per household with a mean

of 1.50 and SD = 1.26. In the two settlements the ranges were also wide 1 -2 and 1 – 6 respectively.

Number of children under five years per household seems to influence water security and adoption of safe drinking water practices. Manyani which had fewest children under five years was water secure and at the same time had the highest percentage of respondents who had fully adopted safe drinking water practices. Conversely, Wamagata had a higher water insecurity score with a mean of 11.06 and SD = 4.14 and lowest in adoption of safe drinking water practices. High number of children under five years raises the demand for water. It is proportional to the water demand. Even one child under five years in a household that is water insecure can be strenuous on the family.

An additional mouth when the income remains the same, does not enable a household to meet most of their needs adequately. Money is directed to meeting the perceived urgent needs. Under such circumstances, adoption of safe drinking water practices is not sustainable. Similarly, water must be bought so a good amount of household income goes to buying water at the expense of adopting expensive methods of water treatment and storage. This exposes the children under five to diarrhoea diseases as with water insecurity hygiene becomes hard to maintain and chances of water contamination are high.

Wamagata and Murogi settlements had features that do not favor safe water drinking practices; 68.8% of respondents in Wamagata were single and 62.5% on informal employment. Correspondingly Murogi had 66% of respondents who were dependent and none of them was on formal employment and only 34% were on informal employment. This scenario indicates that, with a child or two who are below five years, meeting their needs, obtaining water security and sustain safe drinking water practices especially treatment can be a challenge.

4.3 Water accessibility

Water accessibility was measured using the measurement scales described by (Stevenson et al., 2012) on ease of access to water infrastructure capturing water sources, trip to water source and back, time spent queuing for water, household water storage capacity and affordability. Several authors now recognize water accessibility as

part of the measures of water security. Table 4.3 Summarizes results of water accessibility.

Table 4.3: Water accessibility and water security

	Variable	Categories	Manyani % (M± SD)	Murogi % (M± SD)	Wamangata % (M± SD)	Nyamarutu % (M± SD)
Water accessibility	Ease of access to water infrastructure	Piped water connected to house	11.3%	0%	6.2%	5%
		Piped water to compound	88.7%	52.8%	81.2%	36.7%
		Obtain water from sources located outside premises	0%	47.2%	12.5%	58.3%
	Trip to water source		2.25±4.23	23.51±30.28	5.13±9.72	19.47±20.95
	Time taken queuing for water		24.2±53.77	44.49±56.08	8.25±13.20	29.83±20.94
	Affordability		4.91±12.07	10.36±9.48	11.44±15.03	15.16±14.42
	Household water storage capacity		134.72±89.70	169.62±156.88	298.44±220.88	82.18±70.98

Source: Field Data (2018)

a) Ease of access to water infrastructure

Table 4.3 summarizes the ease of access to water infrastructure by settlement type.

The respondents were asked to state their main source of drinking water. Interestingly, all of the households in Manyani relied on two water sources including piped water connected to house and piped water to compound. However, none of the respondents from Murogi had water connected to their house. The findings in this study agree with those of Satapathy (2014) that there are three types of water sources for the slum dwellers including within house, tap to compound and outside the premises.

Ease of access has an implication on water security and consequently adoption of safe drinking water practices. Manyani where respondents collect their water from within the house and tap to compound had low water insecurity score with a mean of 4.50 and SD = 5.45. Likewise, it was the settlement with highest percentage of respondents who had fully adopted safe drinking water practices. On the other hand Nyamarutu which had the highest percentage of respondents collecting water outside the premises had the highest water insecurity score with a mean of 14.93 and SD = 7.12 and also was among settlements with lowest adoption of safe drinking water practices.

Having to collect water outside the premises could be attributed to poor water infrastructure where water connection is not evenly distributed. Many of them rely on a "mix" of water sources including from water vendors especially in Nyamarutu and Murogi. This attribute lowers the incentive to adopt safe drinking water practices. Some of the water may be contaminated increasing the chances of contracting diarrhoea diseases. Water outside the premises or from vendors tend to be costly. This restricts the amount of water that a household can buy in a day. On the other hand, the much money spent buying water denies household the ability to afford water treatment including treatment and safe storage.

b) Duration of trip to and from the water source

The women were asked to estimate the average time they spent to and from the water source. As indicated on table 4.3, the duration of trip to and from water source ranged from 0 – 240 minutes. Women from Murogi considerably spent the long time to and from the water source (mean = 23.51, SD =30.28). This contrasts the case with Women from Manyani who strictly obtained water from pipe connected to house and tap to compound and was consistent in supply. They spent less than one minute to and from the water source (Mean = .34 SD = .48). This can be credited on the water infrastructure being in the compound. Water is within reach. The mothers do not get tired from trekking. Therefore they have the incentive to treat water since they can spare some money for treatment and safe storage. This increases chances of preventing diarrhoea diseases among children under five years.

In Murogi, the water source was far from the household. As a result of long distances to and from the water source, the women get tired and psychologically stressed. Their precious time that could have been spent earning some income is spent drawing water that might not even be enough to meet household needs as well as drinking demands especially in large households. This reduces the income for the household and makes it hard to adopt safe drinking water practices. They have little to save and invest on water treatment and safe storage. Additionally, where the water is inconsistent from the tap, the chances of being contaminated are high increasing chances of diarrhoea diseases infection.

(c) Time spent queuing at the water collection points

Women were also asked to estimate the length of time they spent queuing to fill their containers at the water source. The time spent queuing ranged between 0 – 240 minutes. Evidently, women from Murogi spent the longest time queuing for water (Mean =44.5, SD = 56.08). Inversely, Wamagata spent the least amount of time queuing (Mean = 8.25, SD = 13.20).

Long queuing can be linked to lack of ease of access to water source for example no household in Murogi had water source in the premises while in Nyamarutu only 5% had water connection in the premises. Majority of women collected water from outside the premises. Queuing for long has implication on water security, it reduces the amount of water women can collect in a day and as a result they are water insecure. This as a result poses a threat to adoption of safe drinking water practices. To treat water, there must be some to spare for drinking. The water collected may only be enough to meet other household needs and none is spared to be treated for drinking.

Most of these women are on informal employment so the long time spent queuing in addition to time spent to and from water source could have been used to work and earn some money. The women may skip collecting water at a given time lowering the household water security and subsequently adoption of safe drinking water practices. This may expose the children under five years to diarrhoea since it is hard to observe hygiene when water is not adequate.

(d) Affordability of water

Affordability is a significant measure of household water accessibility (Mason, 2014). Affordability was computed as a proportion of monthly expenditures on buying water compared to a household's overall monthly income. Adopting Mason's (2014) measure of affordability, the respondents were asked for the estimated amount of money they paid for water on a regular month. They were also asked for their estimated monthly income. Table 4.3 summarizes affordability by women with children under five years in the four settlements.

Manyani spent the least amount of money on water (Mean = 3.43 SD = 3.57). Sadly, Nyamarutu spent on average mean 15.16 and a standard deviation of 14.42, meaning that these households spent more money on water relative to their income. This could

have been as a result of large household size. In agreement with the findings of Water and Sanitation Program (WSP) (2014), most of the women are on informal employment that is not supplemented by other sources of income. Low irregular incomes are expected to meet high prices of water (Mason (2014) to provide resources to buy the storage facility. This influences the long-term and short term access to water. When the cost of accessing water is high relative to the income, it is difficult to afford and sustain safe drinking water practices.

Water infrastructure could have also contributed to high cost of water. Comparing Manyani and Nyamarutu, the former had water in the premises and in the compound and it was regular. Their expenditure on water was low while Nyamarutu where most of the respondents accessed water from the outside premises was high. This implies that they have at times to source water from the vendors which is more expensive than water in the premises.

Infrastructure being out of the premises adds on to the time for a trip to and from water source. The farther the distance, the more water insecure the houses are likely to be and the higher the cost in terms of failure to earn money to look for water and increased prices of water from vendors. Granted there are many household needs competing for financial resources, they are left with little savings to spend on water treatment and safe storage. Failure to adopt safe drinking water practices leads to drinking contaminated water and consequently negative health outcomes including diarrhoea diseases in children under five years. This intensifies the financial burden and at the same time reduces the home maker's (mother's) productivity as she has to take time out of work to take care of the sick child.

(e) Household water storage capacity

Due to water scarcity, women collect and store water in the house. Women were asked to state the amount of water they had stored in the house at the time of the survey. Nyamarutu had the least amount of water stored in the household (Mean = 82.18 SD = 70.98) with a significant difference from the other settlements as indicated on table 4.3.This can be credited to a number of factors; there are big household sizes that make the demand for water high so it requires that a lot of water be collected to sustain the consumption. Equally, the water sources are mainly outside the premises for this settlements, which takes a lot of time to and from the water source limiting the amount

of water that can be collected in a day. This is also tiring for the women as they also have other jobs to do besides water collection. In areas that are connected, the water supply is intermittent lowering the amount of safe drinking water available.

The fact that many of them have to collect water outside the premises, there are mainly long queues that women have to follow to fill their containers. This consumes time and reduces the number of trips one can make to collect water in a day. There are also other issues to be addressed for example the women have to look for employment since most of them are on informal employment. In this case they forego collecting water to look for money or have to wait for the spouse to provide. Water being on sale, sometimes the women may not have money to buy large volumes of water so they may tend to buy just enough for the moment. This means that they may also not have money to buy large water containers to enhance storage, afford large volumes of water to store in the house to spare for drinking and treat the water simultaneously. As a result diarrhoea illnesses are likely to rise since the households may not maintain hygiene.

The researcher asked respondents what reasons constrained the volume size of water storage containers. Results of reasons given are summarized in Figure 4.1. Most of the women cited lack of money with Nyamarutu leading, followed by Murogi, Manyani and Wamagata. Justifiably, women from Nyamaurutu and Wamagata depended mainly on informal employment that does not offer regular income and at the same time it is meagre. This limits their choices and are not able to budget for large water containers. The thought of treating water will be far as they have first to think of having water and safety second for no choice of their own. Manyani highly cited that lack of bigger storage was due to the water source reliability. This implies that where water sources are reliable, people do not worry about storage and can allow them to concentrate on water safety no wonder Manyani had high level of full adoption of safe drinking water practices.

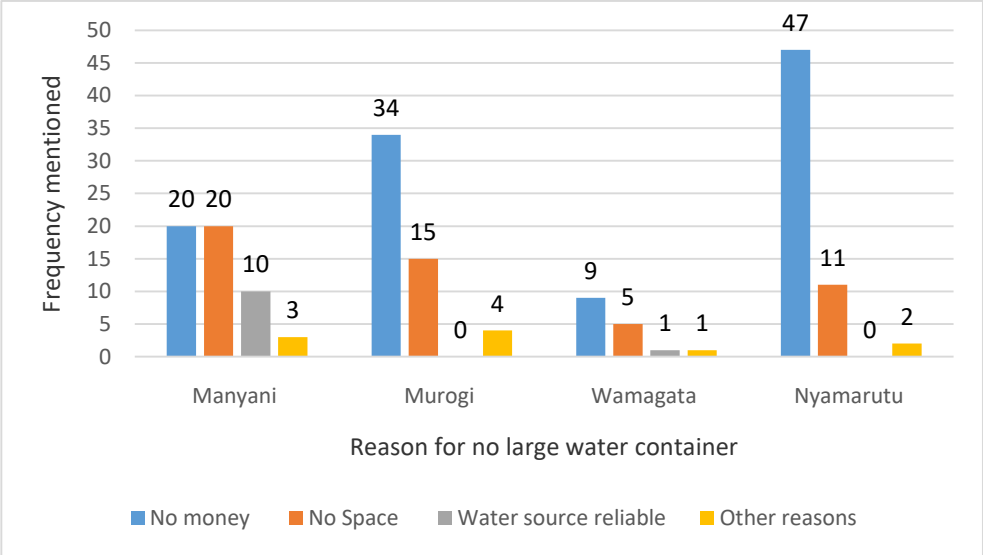


Figure 4: Reasons for not having large water containers

Source: Field Data (2018)

4.4 Water security

The researcher adopted the water insecurity instrument validated and used by (Stevenson et al., 2012). The scores of water insecurity ranged from 0 - 32. According to Stevenson et al. (2012) a scale of 9 points and above indicated worse access to water and water insecurity (Stevenson et al., 2012). From the findings then, except for Manyani, all the three settlements were water insecure for women with children under five.

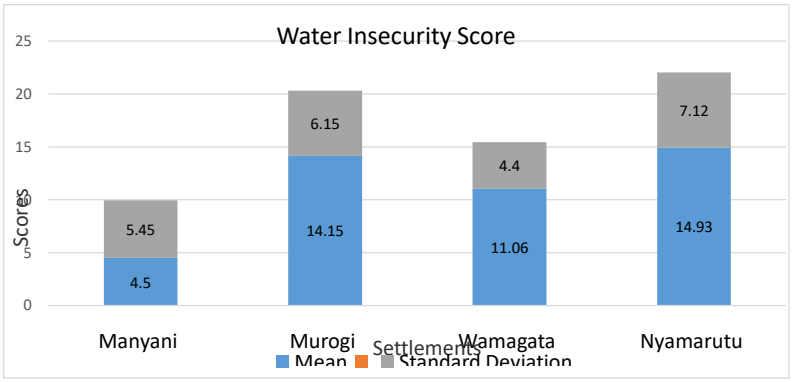


Figure 5: Water Insecurity Score

Source: Field Data (2018)

The 32 statements were grouped into six forms of experiences of water stress related experiences suffered by women as a consequence of poor household water security, as per Stevenson et. al. (2012) scale namely *(i) perceived safety and sufficiency of water supply,(ii) challenges to water access, (iii) social relations related to water,(iv) opportunity costs of water collection, (v) measures used to minimize water use* and (vi) *thirst.* The researcher further assessed the magnitude of water stress related experiences of women with children under five across the four settlements. Results are summarized in table 4.4. Remarkably, Manyani had the lowest proportion of women reporting water stress related experiences.

4.4.1 Perceived safety and sufficiency of water supply

The researcher asked the women whether; they worried that water may not be enough for household needs; and, whether they had taken water they thought was unsafe for health, and if they had collected water from undesirable source.

The findings showed that, they indeed worried; Murogi had the highest percentage of those who worried (94.3%). On the other hand, Manyani reported lowest percentage of mothers who worried that water may not be enough (26.4%). There is a very big difference between the two settlements. The water secure settlement have less stress compared to those who are water insecure revealing inequities. Manyani had a regular and consistent water supply. Some of their water sources were connected to house and majority had tap connected to compound. None of the respondents collected water from outside the premises. They were spared trekking and long queuing. Mothers from Murogi on the other hand had mainly to collect water from outside the premises or water vendors. This implies long distances to water source, more money to buy from vendors if they opted to and long queues since the taps are shared among many people. The worry is intensified where the household size is big because this raises the demand for water. Thus they were not sure of having enough water to meet their drinking and household needs.

Water insecurity influences water priorities, mother mainly concentrate on getting enough water to meet the household needs such as washing clothes, cooking and washing clothes paying less attention to drinking water safety. This exposes the households to using water that may be contaminated and consequently diarrhoea diseases in children under five years. This is confirmed by the fact that some of the

households had consumed water they thought unsafe for health. For instance, Murogi had highest percentage (43.4%) of respondents who had used such water. Nyamarutu was leading with the respondents who collected water from undesirable source (23.3%). Manyani which the lowest water insecurity score reported least percentage of those who had consumed water thought unsafe (7.5%). It is clear that water accessibility influences water security. The more the accessibility the less the water insecurity and possibly the lower the health risks.

4.4.2 Challenges to water access

One statements with eight accompanying reasons to choose from was used to measure challenges to water access as shown in table 4.4; mothers were asked if; *"in the past thirty days, they had failed to collect water when they wanted because; it was too far away/takes too long to get to the water source, it was too risky/ dangerous for life, it takes too long to wait at source/ queues too long, no enough water at the source, was too sick or weak to collect water, baby or child was unwell, had taken sick baby to health clinic or hospital, and had no one to live baby with".*

In all the settlements, women admitted having failed to collect water when they wanted at one point in time, Wamagata had highest percentage (100%) and Manyani had the lowest percentage (43.4%) of respondents who reported the same. This shows the difference in experiences between water secure settlements and water insecure settlements.

Lack of enough water at source was a major challenge. Wamagata had the highest number of respondents who reported this (93.8%). Murogi and Nyamarutu also had relatively high percentages of those who lacked water at source. Manyani had lowest percentage of those mothers who reported lack of enough water at source as a challenge (24.5%). Lack of water could be attributed to the water source being far among the three highly challenged slums and water being near and of consistent supply for water security in Manyani. This implies that the three water insecure slums may not be able to adopt to safe drinking water practices as their water priorities could be more concerned about the quantity than the quality.

Consistent with water infrastructure in table 4.3, Manyani reported lowest percentages of experiences of stress related to water compared to other settlements for example, only 7.5% reported long queues at water source compared to 23.3% in Nyamarutu.

Similarly Manyani reported lowest percentages (24.5%) of women who cited lack of water at source as an obstacle to collecting water when they wanted while Wamagata reported 93.5%. The gap is so wide, a fact that attests that having pipes laid does not justify water security. With 81.2% of water connected to compound in Wamagata, one would expect that they would have water round the clock. However, it is not the case in this study. This can be associated with water infrastructure; none of the respondents from Manyani collected water from outside the premises. They either had it in the house (11.3%) or piped water to compound (88.7%). on the other hand the situation in Wamagata could be attributed to intermittent water supply and as a result are water insecure.

Water in the house and in the compound spares women from dangers such as passing through risky slum streets or having to cross the highway for example none of the women from Manyani reported failure to collect water when they wanted due to risk. The water supply is assured and this leaves the women with time and money to invest on safe drinking water practices unlike their counterparts in other settlements who have to collect water from the outside. The stress can be less as they do not get tired and therefore can look for jobs and increase the household income. This enables them to invest on safe drinking water practices.

Large household sizes such as in Nyamarutu and Wamagata coupled with poor water infrastructure and water irregularity for those who have water connection make water more inaccessible. This raises the cost of water due to the amount required affecting its affordability and making adoption of its safety not only low but unsustainable as well. People may not have spare money to invest on water treatment as well as buying safe water storage containers. On the other hand, when it is risky to collect water, people may not collect enough water as they are restricted to particular times. They become water insecure and lowers the adoption of safe drinking water practices.

Surprisingly Nyamarutu reported more sickness related reasons as hindrances for collecting water when they wanted, 20% of the respondents were too sick to collect water, 11.9% had a child who was unwell, 8.3% had taken baby to hospital, second after Murogi which had 15.1% and to add on this, 13.3% had no one to live baby with. The women are likely to be sick due to the fatigue of having to collect water from far and at the same time following long queues. This exposes them to water insecurity

since they are likely to go without water sometimes. As a result the water treatment and thought of safe storage is undermined and diarrhoea diseases in under-fives may increase as a result. The case was different in Manyani and Wamagata. There were few cases of sickness related reason for not collecting water for instance none reported baby being unwell or lacking someone to live baby with. Only 3.8% reported having taken baby to hospital in Manyani and none in Wamagata, and 6.2% in Wamagata and 7.5% in Manyani reported having been sick. This was low compared to other two slums. In such a scenario, the women will be water secure and are able to focus on water safety with the likelihood of lowering the risk of diarrhoea diseases.

Children sickness is high in the water insecure settlements. They could be suffering from diarrhoea as a result of contaminated water. When the child is sick, the mother tends to worry and all her attention is taken by the same at the expense of water collection. They have to be thinking all the time where the next drop of water will come from. This digresses the attention for adoption of safe drinking water practices to concentrate on health matters. In addition, sickness consumes money and therefore the women may not be left with extra money to invest on water treatment and safe storage.

The issue of sickness can also be attributed to low levels of education. The respondents may not have adequate knowledge on water treatment, storage, handling and the health implications they have on children and the family at large. This is consistent with the findings on level of education on table 4.2 in that, Nyamarutu had the lowest level of tertiary education (5%) followed by Murogi (7.5%). A part from lacking relevant knowledge on water safety, low levels of education to an extent confines the women to informal source of income where the incomes are meager and irregular denying them enough money to buy sufficient amount of water, and invest on water treatment and safe storage.

4.4.3 Social relations related to water

Four statements were used to measure social relations in regard to water. Women were asked whether; *"in the past thirty days, they had taken water from a neighbour because of lack of water at home, in the past thirty days they had a quarrel with a neighbour over water, in the past thirty days they had a quarrel with her spouse over incomplete house work, in the past thirty days she had a quarrel with her spouse over water needs".* Water insecurity also has social implications. Notably, Nyamarutu, Wamagata

and Murogi which are water insecure showed higher percentage of those women who collected water from the neighbors. Nyamarutu had the highest percentage (68.3%) of women who collected water from a neighbor followed by Wamagata (56.2%) and Murogi (54.7%).

This can be attributed to the fact that, majority of them got water from outside the premises. This takes much time and water is still not sufficient. Nyamarutu and Murogi which had high water insecurity scores revealed high incidents of conflict, for example, 35.8% of respondents from Murogi and 25% from Nyamarutu had had a quarrel over water with a neighbor within the last thirty days. Nyamarutu had highest percentage of women who quarreled with the spouse over household water needs at 23.3%. Alongside that Murogi, reported the highest percentage of those who quarreled with the spouse over incomplete household work (34%). This can be occasioned by high demand for scarce resource. In Murogi as shown on table 4.2, where 66% of the women were dependent, increase in demand and price of water means asking for more money from the spouse. The income is constant but the demands are growing. The spouse may start feeling the burden of buying water resulting into conflict. Murogi also had women trek the longest distances to and from water source and time spent on the queue. Precious time is spent on water depriving the women time to attend to other household chores and consequently conflict with the spouse. The husband may not provide money for water treatment making adoption of safe drinking water hard to obtain. This poses risk of diarrhoea diseases in children under five.

4.4.4 Opportunity costs of water collection

Five statements were used to measure opportunity costs related of water collection. The women were asked whether *"in the past thirty days, they had failed to participate in church/call someone who was ill, or attend a funeral, wedding, or women's meeting or social event when she needed because of water collection issues, in the past thirty days she slept very few hours because she woke up very early in the morning to go for water collection, in the past thirty days a male in the household who is a pupil went to school late or stayed home from school to help with water collection, a female who is a pupil from the household went to school late or stayed at home from school to help with water collection, in the past thirty days she cooked undesirable food because there was not enough water"*. Where water is scarce people have to forego many opportunities.

Murogi had the highest number of respondents who reported failure to participate in social events due to water related activities (50.9%) followed by Nyamarutu 45%. Murogi also had the highest number of respondents who slept few hours due to water collection (81.1%) followed by Nyamarutu 70%. The problem of water insecurity also affects children in the household. This is demonstrated in table 4.4, where Nyamarutu had the highest level of school absenteeism to collect water by both boys and girls at 16.7% and 13.3% respectively no wonder the low level of education in the same settlement. Interrupted learning undermines the safe water drinking practices because the pupils may have missed lessons tackling safe drinking water practices denying them adequate knowledge on safe drinking water practices thus a persistent low adoption of the same.

This can be justified by the fact that the water infrastructure is not evenly distributed. In Nyamarutu 58.3% of the women had to access water from outside the premises. Having had a long day at work, and have to do household chores for instance cooking and feeding children. This alongside long queues make them to stay up late or wake up early to collect water. Where the water is connected, at times it is not consistent and is sometimes supplied at night. Other times they opt to collect water early in the morning before they go to work, a time they also want to avoid long queues. Women have to keep alert not to miss the water when it is there. This denotes that the women get very tired and may not care about observing safe drinking water practices as long as they have enough water in the house. This increases chances of children being affected by diarrhoea diseases.

4.4.5 Measures used to minimize water use

Ten statements were used to measure ways of minimizing water use. Women were asked whether; the past thirty days she had reduced the amount of water she used for bathing baby, in *"in the past thirty days, she had reduced the amount of water she used for drinking, she had reduced the amount of water she used for cooking, she had reduced the amount of water she used for washing utensils, she reduced the amount of water she used for washing children's clothes, reduced the amount of water that she used for washing adults clothes, reduced the amount of water she used for washing hands, she had reduced the amount of water she used for preparing food for baby/children, she had reduced the amount of water she used for washing dishes for*

children and she reduced the amount of water she used for cleaning house due to lack of enough water".

All the respondents had at some time reduced the amount of water they used for various activities only the frequency differed. Nyamarutu had the highest number of women with children under five (38.3%) who reduced the amount of water they used for drinking. It was also the settlement with the highest number of the respondents who reduced the amount of water that they used for cooking because of lack of enough water (53.3%), followed by Murogi (41.5%). This poses great risk to health. With water scarcity, food may not have been prepared under hygienic conditions. This confirms why the number of women who reported inability to collect water due to child not being well was highest in Nyamarutu. They could have suffered diarrhoea diseases.

Regarding washing utensils, washing clothes, preparing food for baby and cleaning the house, Murogi, Wamagata and Nyamarutu which are water insecure had over 50% of the women having had to reduce the amount of water they used. They settlements seem to interchange across different activities. Wamagata had the highest percentage of women who reduced the amount of water they used for washing the utensils (81.2%) followed by Nyamarutu with 80%. Nyamarutu had the highest percentage of respondents who reduced the amount of water they used for bathing baby (80%), followed by Wamagata (75%) and Murogi (73.6%). This is a reflection of water insecurity and consequently health risks.

Wamagata had the highest percentage of women who reduced the amount of water they used for washing children's clothes (87.5%), followed by Nyamarutu (85.0%) and Murogi (81.1%). Wamagata also had the highest percentage of women who reduced water for washing adult's clothes (93.8%), followed by Murogi (83%) and Nyamarutu (50%). In Nyamarutu 68.3% of the women reduced the amount of water they used for washing hands, followed by Wamagata (62.5%), then Murogi (60.4%). 71.7% of women from Nyamarutu reduced the amount of water they used for preparing baby food followed by Wamagata (56.2%) and Murogi (60.4%). The water for washing children dishes was also reduced. In Nyamarutu, 80% of the respondents reduced the same, followed by Murogi (69.8%) and Wamagata (62.5%). Nyamarutu also reported the highest percentage of those who cooked undesirable food due to water scarcity (26.7%). This situation may make the mothers to worry more to acquire water for other

household needs above the motivation to treat it. They are only happy to get water. As a result chances of children suffering diarrhoea diseases are intensified because water is likely to be contaminated where rationing of water includes washing hands and utensils. This could also suggest that even the water containers may not be washed.

These patterns explains why in Manyani where households are considered water secure, there is no incident of a women having not collected water as a result of having taken the child to hospital. Similarly, Manyani reported the lowest percentage of women who cooked undesirable meals due to lack of enough water (1.9%), compatible with findings on table 4.4 where Manyani reported low percentages (7.5%) after Wamagata (6.2%) of women who failed to collect water when they wanted due to child's sickness. Manyani could be this way due to their regular and easy access to water and the possibility of being able to treat water.

Having to ration water compromises hygiene and exposes children to diarrhoea diseases. Some of the factors on table 4.3 may help explain this situation. Due to poor water infrastructure, resulting to women having to trek long distances to collect water, they tend to minimize water use to allow the little water to last and save them having to go often to collect water. This will allow them to work longer and make some extra money to enable them meet other household needs. Low education level may contribute to their priorities in water rationing being wrong, for example reducing water for washing dishes both for adults and for children, also for cooking children's food and washing hands predisposes the household and especially children under five years to diarrhoea diseases due to contamination.

Water being on sale and the women being on informal employment and others dependent, forces them to cut down on the water usage leading to bad health outcomes and increasing more stress on the women. Large household sizes in such settlements as Nyamarutu and Wamagata incline the women to reduce the amount of water so as to stretch the same and meet all the household water needs. The fact that water for washing clothes and for bathing is reduced the women might feel inhibited from interacting freely due to shame as this affects their self-esteem. Due to this they may prefer to buy water for washing clothes and bathing at the expense of investing on safe drinking water treatment and storage. Water insecurity seems to make people be more conscious of the amount of water they use.

4.4.6 Thirst

One statement was used to measure thirst women were asked whether*; "in the past thirty days, they had gone the whole day without drinking water because there was not enough water"* Women were asked whether anyone in the household could have gone without having taken water a whole day in the past thirty days. Shockingly, 23.3% of the households from Nyamarutu had gone for a whole day without water followed by Murogi (18.9%). Again, a situation that can be a great source of stress. This phenomenon can be attributed to a set of factors observed in table 4.2 such as large household sizes in Nyamarutu and Wamagata. The rate of water consumption is high and drinking water availability may not be sustainable. Being on informal employment or dependent, money may not be sufficient to buy enough water for the large households so there can be literary no drop of water in the household; the money has to be distributed among different pressing household needs. This implies that once water is found the women may not give much attention to ensuring its safety. Low levels of education may influence their decision making. This is mainly when it comes to budgeting and prioritizing. They may not have adequate knowledge regarding the need to have water first for health and how to make it safe for drinking. So they may give more attention to other perceived pressing household needs neglecting water availability and safety. As a result the risk of diarrhoea diseases increases.

Water infrastructure can also contribute to water insecurity, water supply could be inconsistent coupled with shortage of water storage capacity. The time spent to and from the water source may dictate the amount of water that can collected in a day. Nyamarutu and Murogi as shown on table 4.3, had long treks to and from the water source. At the end of the day the women are tired from the journey and the length of time spent waiting on the queue. As indicated above, in Nyamarutu where ill health related reasons for not collecting water when wanted were high, the households may have run out of water exposing the children under five years to oral fecal contamination. This is a sign of low adoption of safe drinking water practices.

Table 4.4: Percentages of women who reported stress related experiences in relation to water by settlement.

I	**Perceived safety and sufficiency of water supply**	Manyani (n = 53)	Murogi (n = 53)	Wamagata (n = 16)	Nyamarutu (n = 60)
	Worry that water may not be enough for household needs	26.4%	94.3%	62.5%	80%
	Took water thought unsafe for health	17.0%	43.4%	25%	41.7%
	Collected water from undesirable source	7.5%	22.6%	12.5%	22.3%
II	**Challenges to water access**				
	Did not collect what when wanted	43.4%	80.8%	100%	83.3%
	Water source far	0.0%	22.6%	0.0%	18.3%
	Too risky	0.0%	13.2%	0.0%	1.7%
	Long queue	7.5%	22.6%	12.5%	23.3%
	No enough water at source	24.5%	71.7%	93.5%	71.7%
	Too sick or too weak to collect water	7.5%	17.3%	6.2%	20.0%
	Baby/child unwell	0.0%	9.4%	0.0%	11.9%
	Taken baby to clinic/ hospital	3.8%	15.1%	0.0%	8.3%
	No one to live baby with	0.0%	13.2%	0.0%	13.3%
III	**Social relations related to water**				
	Took water from neighbor	26.4%	54.7%	56.2%	68.3%
	Quarreled with a neighbor over water	18.9%	35.8%	6.2%	31.7%
	Quarreled with husband over incomplete house work	7.5%	34%	6.2%	25%
	Quarreled with husband over household water needs	11.3%	20.8%	12.5%	23.3%
IV	**Opportunity costs of water collection**				
	Lack of participation in social events	32.1%	50.9%	31.2%	45.0%
	Slept few hours due to water collection	39.6%	81.1%	87.5%	70.0%
	Cooked undesirable food due to lack of enough water	1.9%	22.6%	12.5%	26.7%
	Kept girl child out of school to collect water	0.0%	3.8%	0.0%	13.3%
	Kept boy child out of school to collect water	0.0%	1.9%	0.0%	16.7%
V	**Measures used to minimize water use. Reduced amount of water used for:**				
	Drinking	13.2%	32.1%	12.5%	38.3%
	Cooking	15.1%	41.5%	6.2%	53.2%
	Washing utensils	26.4%	73.6%	81.2%	80%
	Bathing baby	26.4%	73.6%	75%	80%
	Washing children's clothes	28.3%	81.1%	87.5%	85%
	Washing adult clothes	34%	83%	93.8%	50
	Washing hands	20.8%	60.4%	62.5%	68.3%
	Preparing food for baby/children	17%	52.8%	56.2%	71.7%
	Washing dishes for children/baby	24.5%	69.8%	62.5%	80%
	Cleaning house	28.3%	86.8%	93.8%	85.0%
VI	**Thirst**				
	Went whole day without water for lack of enough water	1.9%	18.9%	6.2%	23.3%

Source: Field Data (2018)

4.5 Adoption of drinking water safety practices

The researcher assessed adoption of drinking water safety practices using two measures, namely, water treatment and method of water storage.

4.5.1 Adoption of water treatment practices

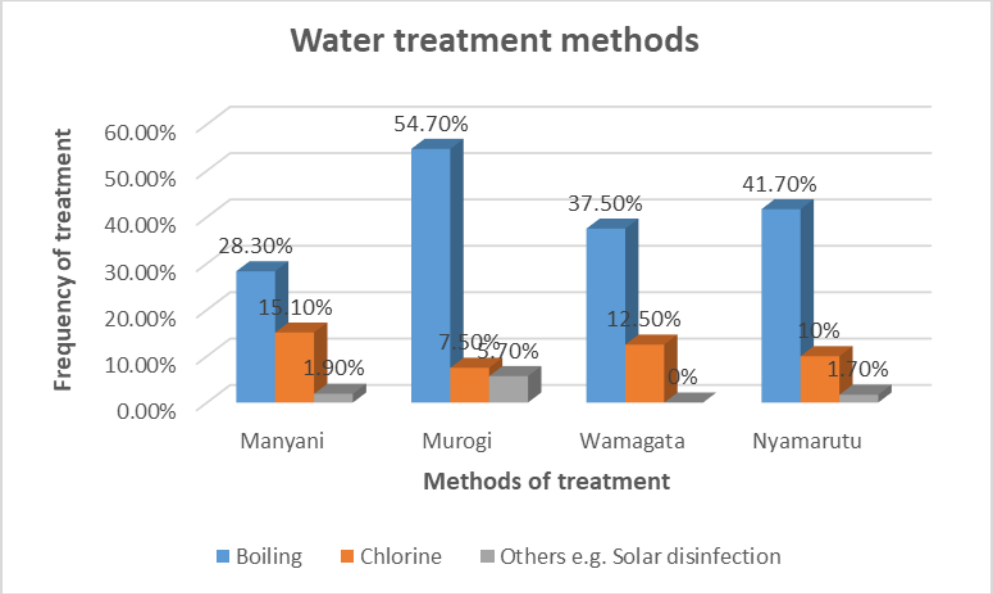


Figure 6: Water treatment methods

Source: Field Data 2018

The respondents were asked to state the methods they used for treating drinking water. Boiling method was dominant across all the settlements followed by chlorination and a few used solar disinfection bottles. This contrast findings by Subbaraman et al. (2013) that showed that very few households in Mumbai slums boiled water. Murogi had the highest number of those who used boiling method (54.7%) followed by Nyamarutu (41.7%). Seemingly this is the most trusted method of drinking water treatment. However it can be a challenge to maintain this kind of water treatment method because most of them are either on informal employment or are dependent and therefore their income is unreliable. Being in town where everything has to be purchased including water, the women with children under five years may have to buy charcoal for boiling water, which is expensive.

On the other hand the household size is big for instance in Nyamarutu with a mean of 5.12: SD = 1.89. It is hard to boil large amounts of water daily. It is costly and the women have to choose between buying charcoal to boil water or to cook food for the household. The findings indicate that, there are attempts to treat water but price of

water and the methods of treatment are obstacles to full adoption. Manyani had the highest percentage of women who did not treat water (54%) followed by Wamagata 50%, then Nyamarutu 46% and Murogi 32.1%. The reasons for not treating water are explained in the next section as illustrated by the graphs.

4.5.2 Reasons for not treating water by households

For respondents who did not treat water, the researcher further probed reasons for not treating. Responses were tallied using excel for most frequently to least mentioned reasons as summarized in the following graphs.

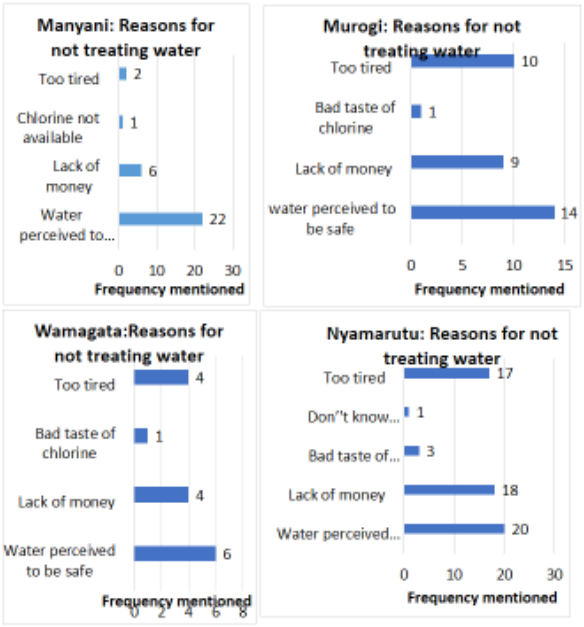


Figure 7: Reasons for not treating water in Manyanin, Murogi, Wamagata and Nyamarutu

Source: Survey Data 2018

The commonly mentioned reasons across the settlements included water perceived to be safe, lack of money, too tired, bad taste of chlorine and chlorine not available. Manyani, where 54.7% of the respondents did not treat water cited perception that the water is already clean as the major reason. This was mentioned 22 times. This can be attributed to the fact that their tap water supply which is an improved water source is regular hence the perception that it is safe. This is confirmed by their low mean water insecurity score mean of 4.5 and standard deviation of 5.45. They entirely rely on piped water connected to house or to compound. This indicates that they are sure of their water source and are inclined to trust it, thus they drink it without improving it.

In Murogi, the two highly mentioned reasons were water perceived to be safe (14 times), too tired (10) and lack of money (9). Water being perceived as safe for drinking was highest in every settlement, followed by lack of money and being too tired third highest. In Nyamarutu reasons highly mentioned were, water being perceived to be safe (20), lack of money (18) and being too tired (17). The same trend was observed in Wamagata with additional bad taste of chlorine. This may be associated with a combination of lack of knowledge on how and the need to treat drinking water and the consequence of the same. This applies mainly to Murogi, Wamagata and Nyamarutu where their water sources are not consistent.

Water insecurity seems to have a key role to play in adoption of safe drinking water practices. The water insecure slums seems to have reasons that indicate that if water was available things could have been different. Failure to treat water especially in Nyamarutu where though water insecure and accessing water from multiple sources could have been contributed by various factors as indicated by table 4.2 and 4.3. Low the financial status deny them enough water as they cannot afford a lot of it to meet all needs. As a result they may not adopt safe drinking practices which entails treating and keeping in safe storage containers. As mentioned earlier, most of the women prefer boiling water as one of the treatment methods yet it is very expensive. Many of the women being on informal employment and others dependent, might have little money that may not meet the expensive methods of treatment as well as other household needs lowering the level of adoption of water treatment.

Being tired was another reason commonly mentioned by Nyamarutu (17 times) and Murogi (10 times). This is consistent with the water being outside the premises and time spent on the queue to collect water as indicated on table 4.3. Women from these two settlements spend a lot of time trekking to the water source and once at the water source, they have to wait on the queue to fill their containers. These, in addition to a long day of seeking and doing informal jobs mostly household work or gardening may make the women very tired and weak. This affects their health and they are not able to collect enough water for the household to spare for drinking. At the same time when they are tired, they may not be able to go for jobs. This reduces their income and makes adoption of water treatment unaffordable and unsustainable. As a result diarrhoea diseases in children under five may occur due drinking untreated water.

Though chlorine was not a common method of water treatment, its bad taste was mentioned once. Using chlorine would be one of the most effective methods of water treatment because it does not seem to be expensive and can be used to treat a large amount of water. Bad taste probably is discouraging and may be the reason why not many people were using it. This lowers the rate of water treatment adoption with ever increasing incidents of water contamination and resultant diarrhoea diseases.

Large household size could have also contributed to water insecurity. The demand for water in such houses is high. As a result the women prefer to meet other competing household needs. This makes adoption of water treatment unaffordable as well as unsustainable. The children then risk diarrhoea diseases.

4.5.3 Adoption of safe storage practices

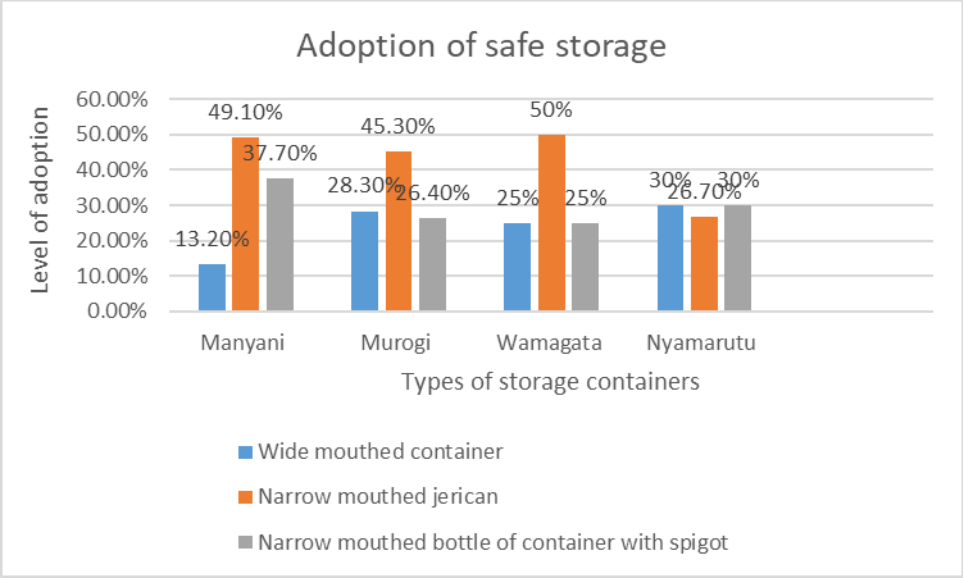


Figure 8: Adoption of safe Water storage
Source: Field Data (2018)

Women with children under five years were asked to mention the kinds of containers they used to store drinking water. The results are summarized in figure 4.7. Notably, Nyamarutu had the highest proportion of respondents who stored water in wide mouthed containers deemed unsafe (30%), followed by Murogi (28.3%). They prefer to store water in wide mouthed buckets and large plastic containers ("skyplast"). In agreement with results in table 4.3, this may be attributed to the water infrastructure. Where women rely on water from outside the premises, the incentive to store water to avoid several trips and long queues at water source is high. They prefer big containers

which have a big capacity and most often happen to be wide mouthed. Such an attribute as a result, exposes water to risk of recontamination and makes adoption of safe drinking water un achievable.

Low levels of education in Nyamarutu where 68.8% of the women had mainly no formal or primary education may also contribute to poor water storage practices. They may not adequate knowledge that might help them adopt safe drinking water practices. This is in contrast to Manyani where the number of women had highest tertiary education (15.1%). They may have adequate knowledge on safe water storage thus had lowest number of women storing water in wide mouthed containers (13.2%) and the highest percentage of those who stored water in narrow mouthed container with a spigot (37.7%).

Awareness of potential risks posed by wide-mouthed water storage containers

Women who used wide mouthed containers were asked what motivated them to use that kind of storage. They cited different reasons for preference of storing water in wide mouthed containers that included, "*Keeps water clean, keeps water cool, cheap, only available and affordable method of storage, easy to draw water, water lasts long, particles settle at the bottom, and easy to clean*"

The table below summarizes the various reasons frequently mentioned by women with children under five years in the informal settlements and the number of times each reason was mentioned.

Table 4.5: Motivations for preferring wide mouthed containers

Motivation	Manyani n=	Murogi n=	Wamagata n=	Nyamarutu n=
Keeps water clean	-	2	1	-
Keeps water cool	2	2	-	2
Cheap	-	-	-	1
Only container available	-	1	-	7
Easy to draw water	2	2	-	-
Water lasts long	-	-	-	1
Particles settle at the bottom	-	-	1	-
Easy to clean	-	1	1	1

Source: Field Data (2018)

Remarkably, women from Nyamarutu seemed to prefer the wide mouthed containers (Figure 4.7). They seem to have motivations that care about the quantity and cost but not the quality of water for example the only container available as the motivation was mentioned seven times. Similarly, there was one mention of the containers being cheap. This indicates that they have no drinking water specific storage and narrow mouthed containers. Many of them being on informal employment, their income is meager and irregular therefore many not afford narrow mouthed containers perceived to be expensive.

Another reason as to why the women preferred wide mouthed container was that the water lasts long mentioned once and only in Nyamarutu. This can be attributed to a number of factors; as indicated in table 4.2, they have large household sizes that demand having a large amount of water at a given time. This way, they are inclined to go for large containers that incidentally happen to be wide mouthed. Most of the women from Nyamarutu are single denoting that they have to work hard to sustain their families. To avoid failing to go to work in pursuit of water, they may be motivated to seek large containers which often are wide mouthed. Correspondingly, the water infrastructure contributes to this, most of the women get their water outside the premises. This necessitates them to draw large amounts of water for storage to reduce the number of days they go to collect the same from the source and avoid long queues. Most of them go out to work therefore, large containers which happen to be wide mouthed are preferred since they hold large amount of water once filled and give the women time to go for the informal employment. This kind of storage inadvertently exposes drinking water to contamination and therefore lowers the level of adoption of safe drinking water practices.

Another reason likely to make Nyamarutu respondents less water safety conscious is that, many of the respondents (68.3%) had mainly primary education and below. This indicates that they may not have satisfactory knowledge on safe drinking water practices unlike their contemporaries in the other settlements, lowering the level of adoption of safe drinking water practices. At the same time, Nyamarutu had the lowest number of respondents who were married (60%). This means that 40% of the women were heading their large households single handedly. The situation indicates that they have to sometimes decide either to meet household needs such as food, fuel to cook and pay rent or to purchase specific containers for drinking water that are narrow mouthed

such as jericans and bottles. This undermines the efforts to adopt safe drinking water practices exposing households to diarrhoea diseases in children under five years.

4.5.4 Adoption of safe drinking water practices by both treatment and storage

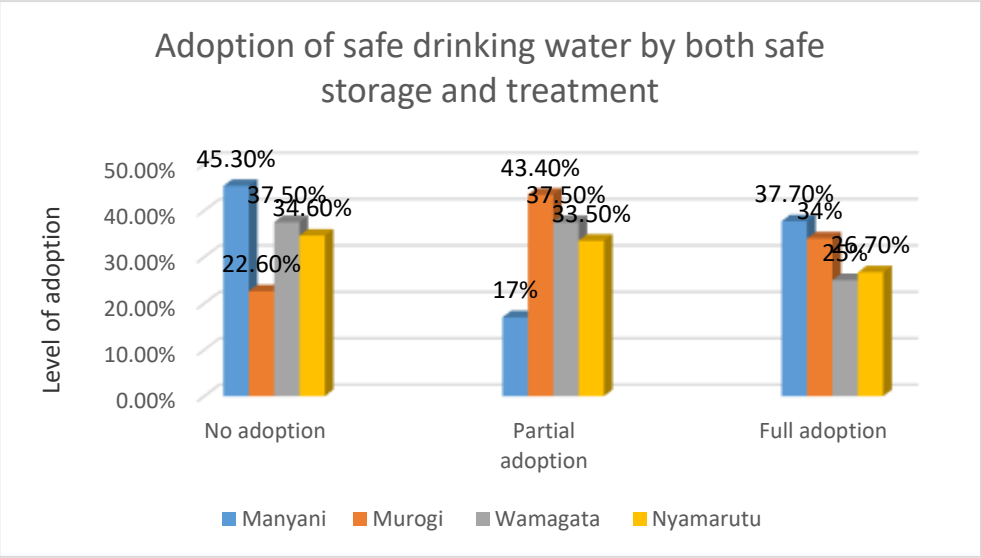


Figure 9: Adoption of safe drinking water by safe storage and treatment
Source: Field Data (2018)

Adoption of safe drinking water practices was further assessed using a combination of both water treatment and methods of drinking water storage. The researcher classified adoption into three levels namely zero adoption if the women stored water in a wide mouthed container and did not treat it, partial adoption if the women only treated and stored water in a wide mouthed container and vice versa and full adoption where the women both treated the water and stored it in a narrow mouthed container.

Manyani had the highest level of full adoption of safe drinking water practices (37.7%). This can be credited on some of the factors for they had good water infrastructure that assured them of regular water supply. This spared them time that could have been spent trekking and queuing for the same. They save money as well as time and the women are not very tired so they can think of treating water. This alongside high marital patterns where they could have got support from their spouses enabled them to afford water treatment.

The relatively high level of secondary and tertiary education may could have offered them some knowledge on safe drinking water practices, increasing the level of

adoption. The households are also small indicating that the need for water is less than in other settlements and women may be able to spare drinking water that can be treated.

Wamagata had the lowest level of full adoption (22.6%) followed by Nyamarutu (26.7%). This can be linked to an intersection of a number of factors: These settlements have relatively large household size (table 4.2), creating high demand for water. This reduces the amount of water that can be stored in the house, thus making safe drinking water practices unsustainable. A lot of water goes into meeting household water needs and sometimes leaves none to spare for drinking, lowering the level of adoption. The level of education is also low since majority of the respondents mainly have primary education and below possibly hindering them from adopting safe drinking practices fully for lack of adequate knowledge.

The women from Wamagata and Nyamarutu were also, mainly on informal employment. This form of earning livelihoods brings in little and irregular income, making it hard to afford basic household needs and sustain safe drinking water practices concurrently.

In line with table 4.3, Poor water infrastructure characterized with water outside the premises and long distances also lowers the level of safe drinking water practices adoption especially in Nyamarutu. In the same way queuing for long, shifts the focus from water quality to water quantity. They get tired and may not take extra time to treat water lowering the level of full adoption of safe drinking water practices. The households risk water consuming contaminated drinking water exposing children under five to diarrhoea diseases.

4.7 Regression analysis – explanatory variables for water insecurity

Table 4.7 summarizes the inter-correlations between water insecurity and other variables. Water insecurity was positively correlated with household size, meaning that, women with bigger households experienced higher insecurity compared to women with smaller households. This is not surprising especially because, when there is no piped water infrastructure on the premises, women have to carry water on their backs from point of collection to their households. Demands for water increase remarkably with an increase in the family size.

Water insecurity was negatively correlated (-0.27) with monthly incomes, meaning that, women with meager incomes were also likely to suffer from water insecurity. Water insecurity was positively correlated with affordability, that is, the amount of money a women spent purchasing water relative to their income, meaning that women paying more to obtain water were also more likely to experience water insecurity. Unfortunately, in the slums where there was no piped on water on premises, majority of the women relied on water from water kiosks. Water kiosks are often run by private individuals, and the cost of water per 20-litre jerrican is always higher compared to piped water. Water insecurity scores were negatively correlated with a household water storage capacity, meaning, household who could afford large storage containers were less likely to experience higher levels of water insecurity. Both the time spent looking for water and queuing at water sources, waiting for containers to be filled up, were positively correlated with water insecurity scores. That means, women, especially those who lack water within the premises, and have to trek to look for and collect water, were also likely to be water insecure.

Results of hierarchical regression show that woman's socio-economic status, particularly income statistically influenced water security (-0.91) (Table 4.7.1). After controlling for a women's socio-economic status, the four factors with statistically significant influence on water insecurity were, household size (0.18), presence or absence of stand pipe within the premises (- 0.23), time taken to collect water (0.21), and the time women spent queuing for water (0.23) (Table 4.7.1).

Table 4.7: :Inter-Correlation among Variables that Determine Household water security

	M	SD	Cronbach's Alpha	Water insecurity	Household income	House hold size	Piped water on premises – YES / NO	Afford ability	Time taken – trip to water source	Time taken queuing for water	Household water storage capacity
Water insecurity	11.32	7.60	0.93	1							
Household size	4.71	1.71	-	0.23**	1						
Approximate monthly income	9715	8022	-	-0.27**	-0.01	1					
Affordability	10.45	13.06	-	0.31**	0.14	-0.42	1				
Piped water on premises – YES / NO	-	-	-	-0.44**	-0.09	0.28**	-0.31	1			
Water storage capacity	141.96	136.58	-	-0.19**	0.25**	0.17	-0.11	0.26**	1		
Time taken to collect water	14.37	22.43	-	0.40**	0.05	-0.20	0.22	-0.38**	-0.26**	1	
Duration taken queuing for water	0.62	0.49	-	0.55**	0.03	-0.23	0.14	-0.24	-0.10	0.31**	1

*$p < 0.05$, ** $p < 0.001$, N = 182

Table 4.8. Regression Analysis on water security Predictors

Model 1	**Variables**	**ß**	**T**	***P***
	Monthly income	-0.27	- 3.69	0.01
Model 2	**Variables**	**ß**	**T**	***P***
	Estimated monthly income	- 0.91	-1.35	0.18
	Household size	0.18	2.83	0.005
	Affordability	0.11	1.57	0.12
	Water in premises – YES/NO	- 0.23	- 3.30	0.001
	Water storage capacity	- 0.90	- 1.28	0.20
	Time duration to collect water	0.21	3.17	0.002
	Time taken queuing for water	0.23	3.84	0.001

Results of the multiple regression model (Table 4. 8) revealed four significant predictors of household water security. These were: Time taken queuing for water; Time taken to travel to and from the water source, household size and monthly income.

The later showed a negative influence meaning that lower household income would signal water insecurity.

4.8 Summary of the Chapter

This study was a descriptive survey that generated quantitative and qualitative data. The target population was women with children under five years in four slum areas in Nakuru Municipality while the accessible population was women with children under five years in the four slums (Nyamarutu, Wamagata, Murogi and Manyani). Proportional random sampling procedure was applied to collect the sample size of respondents. Self-administered questionnaire and observation were used to collect data in an ethical way. SPSS Version 20 computer program was used to analyze data according to set objectives as well as the research questions.

This chapter has reviewed how the independent variable influenced the dependent variable in this study. The independent variables were individual socio-demographic characteristics, knowledge and attitude, access to improved water source, and household water insecurity. The dependent variable was adoption of safe drinking water practices. The findings reveal that there is a close interrelationship between the independent and dependent variables in this study.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Introduction

The chapter summarizes key findings, conclusions and recommendations. The study sought to investigate the influence of household water security on adoption of safe drinking water practices among women with children under five years in Nakuru Town's urban informal settlements. Four settlements were studied namely, Manyani, Murogi, Wamagata and Nyamarutu. It also summarizes the contribution to the existing body of knowledge and gives suggestions for areas of further research coming from the gaps identified.

5.1 Socio-demographic characteristics of the sample

The study established that majority of the women were married. Manyani and Murogi had the highest number of women who were married while Nyamarutu had the lowest marriage pattern followed by Wamagata. Their ages ranged between 18 and 56 years. Manyani and Nyamarutu had women with much younger age followed by Murogi and Wamagata. The study established that marriage by itself may not justify water security, for example Manyani is high in water security while Murogi which tallies with Manyani in marriage pattern is highly water insecure. Similarly age did not seem to be a determinant of water insecurity. This is reflected by the patterns in Manyani and Nyamarutu. Manyani is water secure while Nyamarutu had highest water insecurity yet they have the same age of mothers.

Nyamarutu and Wamagata had majority of the women with low levels of education. They had mainly primary and below. Manyani had the highest level of tertiary education followed by Wamagata. Granted that Manyani and Wamagata have higher tertiary education levels, one would expect that Wamagata would be water secure. However, the gap between the two in terms of water insecurity is quite wide. This suggests that level of education, though knowledge seems to be important for adoption of safe drinking water practices may not be a determinant of water security.

From the findings source of income seems to have impact on water security and consequently adoption of safe drinking water. Majority of the women were on informal employment, with Wamagata having the highest percentage followed by Nyamarutu, Manyani and Murogi. None of the respondents from Murogi had formal source of

income and majority of them were dependent. Manyani which had a balanced varied sources of income had the lowest water insecurity level and accordingly had the highest adoption of safe drinking water practices. Those women with children under five years are better off living in Manyani than in the other three settlements.

Household size also according to the findings had an influence on safe water security and as a result facilitated adoption of safe drinking water practices. Nyamarutu had the highest mean of household size while Manyani had the lowest mean. Compatibly Nyamarutu had the highest water insecurity score and Manyani had the lowest. The patterns of safe drinking water adoption were corresponding, Nyamarutu had the lowest adoption of safe drinking water practices while Manyani had the highest. So the household size is proportional to water security and subsequent safe drinking water practices. This implies that where households are small, mothers can afford water security and be able to adopt safe drinking water practices.

The findings established that owning a house may not guarantee water security. In this case, Nyamarutu had the highest percentage of women who owned the house they lived in followed by Wamagata. Manyani had the highest percentages of women who rented house followed by Murogi. However, though it would be expected that the women in Nyamauru have water security, this was not the case in this study. Nyamarutu had the highest water insecurity and on reverse, Manyani had the lowest. This is confirmed by the level of adoption of safe drinking water practices where Manyani was highest in adoption and Nyamarutu was the lowest.

The findings established that the number of children under five years in a household influence water security. Manyani which had few children under five years per household had lowest water insecurity score while other settlements that had more children had higher water insecurity scores and similarly lower level of adoption of safe drinking water practices. the fewer the children the less the demand for water and as a result the mothers can afford safe drinking water practices in terms of water treatment and safe storage and meet other competing household need needs. As a result diarrhoea diseases can be prevented.

5.2 Water accessibility and water insecurity

Various aspects related to water accessibility play a role in water security. The findings reveal that having water in the house and tap to the compound have an influence on

water security. In Manyani where all the respondents did not go for water outside the premises the water insecurity score were highest. Manyani had the highest number of households with water connected to the house while, none of the households in Murogi had water connected to their households. Nyamarutu had the highest number of respondents getting water from outside the premises followed by Murogi. Slums where respondents collected water from outside the premises had lower higher levels of water insecurity score. For example Nyamarutu which had the highest percentage of women collecting water outside the premises was highest in water insecurity. Having to go for water outside the premises does not give the incentive to adopt safe drinking water practices.

Water outside premises coupled with the duration of trip to and from water source and long time spent queuing heightens water insecurity. Quality time that could have been spent earning some income or doing some development activities goes to water collection. On the other hand, the women get very tired, the amount of water they collect is also not enough for all household chores and if they hire vendors the water is more expensive. This situation hinder the mothers from adopting safe drinking water practices and increases health risks for children under five years. The households cannot afford and sustain safe drinking water practices. Increase water access can increase water security and as a result raise levels of safe drinking water practices.

The findings established that due to water scarcity, women collected and stored it in the house. Nyamarutu had the least amount of water stored in the household with a significant mean difference from the other three settlements. The cost of obtaining water makes it hard to obtain sufficient and adequate water storage facilities. This impact on water security and the adoption of safe drinking water practices. This could be contributed by lack of money to buy adequate storage containers. Water infrastructure could also have contributed to low water storage. To treat water, there needs to be water set aside for drinking, when water supply is inconsistent this can be hard. Many women did not separate water for drinking from for other uses. So when all water was finished there was not water at all.

5.3 Water affordability

Affordability is another significant measure of household water accessibility and consequently security. This refers to the proportion of monthly expenditures on buying

water compared to a household's overall monthly income. All the settlements except Manyani spent more than ten percent of their income on water.

Most of the women being on informal employment, having to go for water outside the premises and long queues, reduced their income. This has an impact on the amount of water that can be purchased as it is for sale in these settlements and at the same time determines the amount of water that can be stored. The cost of water increases water insecurity and consequently the level of adoption of safe drinking water practices goes down.

5.4 Water security by informal settlements

Manyani had the lowest mean of water insecurity score while Nyamarutu had the highest mean of water insecurity score followed by Murogi and Wamagata therefore, except for Manyani, all the three settlements were water insecure for women with children under five. Similarly, Manyani had the lowest proportion of women reporting water stress related experiences. The women indeed worried about not having enough water to meet their household needs during the 30days. This implies that water insecurity is associated with stress among women with children under five years. As a result women are not motivated to treat water. They seem to be more concerned with getting water to meet other household needs at the expense of water treatment. As a result households are exposed to diarrhoea diseases especially among children under five years.

Socio-demographic characteristics that seem to influence water security included; source of income, many respondents were on informal employment. This kind of livelihood is not consistent and the income is meagre therefore it makes it hard to afford enough water and treatments and safe storage at the same time. As a result the adoption of safe drinking water is not feasible and even when attempted it is not sustainable. The situation poses health risks particularly diarrhoea among children under five years.

Household size also challenged water security. It is proportional to the amount of water required for meeting household needs and treat for drinking. With water being on sale, affording it is hard not to mention being able to treat large amount of water for drinking

each day. In such a situation people may opt to use untreated water putting the households at risk of diarrhoea diseases.

The number of children under five also influence water security. Where there are many children under five years the demand for water is also high for such activities as washing clothes and bathing. This raises the cost of living as water is purchased. Resultantly the women may opt to forgo treating water. They may not have much money left to afford the same. The household may consume contaminated water exposing the children under five years to diarrhoea diseases.

Water accessibility was also a factor that influenced water security and adoption of safe drinking water practices. The findings reveal that in Manyani, all the respondents collected water from tap connected to house and from the tap to compound. This spared them time trekking to and from the water source and queuing at the water source. Conversely, the results showed that, the slums that were highly water insecure especially Nyamarutu and Murogi had a high percentage of the respondents collecting water from outside the premises. They also spent long time trekking to and from the water source and queuing at the water source. This scenario reduces the amount of water accessible to the household. On the other hand quality time goes in to the task of collecting water at the expense of jobs that could help increase water quantity and afford its treatment. Likewise it gives priority to water quantity rather than water quality posing health risks in children under- fives.

The fact that most of respondents are on informal employment which is inconsistent and meagre, water affordability becomes a challenge. As a result, respondents choose to meet other perceived household pressing needs. Such a situation undermines adoption of safe drinking water. People seem to drink water when they have it and its safety does not seem to be a priority. Thus increasing chances of diarrhoea infections in children under five years.

The study also showed that water storage is a common occurrence where water is scarce. As such it influences water security. For instance in Manyani where water supply is consistent, people do not need to store water. However, they have a choice to store water or not for any eventuality. Contrary, in Nyamarutu, the respondents suffer water insecurity and so they have to store water in the house as their water supply is not

consistent. This slum had the least amount of water stored. A factor that could have been contributed to by water supply inconsistency, distance from the household to the water source, time queuing and lack of money to buy enough water. Household size also may contribute to water accessibility since the larger the family size the higher the demand for water so it is likely people can go without water as was demonstrated that some households went the whole day without taking water. This implies that drinking water safety my not be a priority. This in the end risks people's health especially children under five years.

5.5 Adoption of safe drinking water practices – Storage and Treatment

Adoption of safe drinking water practices was assessed using a combination of both water storage and treatment methods. Adoption was classified into three levels namely zero, partial and full adoption. Zero adoption if the women stored water in a wide mouthed container and did not treat it, partial adoption if the women only treated and stored water in a wide mouthed container and or stored in a narrow mouthed container and did not treat, and full adoption if the women both treated the water and stored water in a narrow mouthed container. Manyani had the highest level of full adoption of safe drinking water practices. Wamagata had the lowest level of full adoption followed by Nyamarutu. Most of the households did not have a distinction between drinking water and water for domestic uses. Most of the respondents who treated water preferred boiling method with Murogi leading followed by Nyamarutu, Wamagata and Manyani. Majority of the women believed that the water from the tap was already treated and ready for drinking.

Water treatment seemed to be influenced to some extent by the perceptions people have about water safety. For example people seem to trust water from the tap. However in agreement with Subbaraman et al. (2013) water can be contaminated from the source posing threat to health when people do not treat it. On the other hand, water treatment methods that people choose can also influence adoption of safe drinking water practices, for example, many people seemed to use boiling method which is more expensive than others such as Solar Disinfection (SODIS) method and chlorination. This makes it unaffordable and unsustainable.

Household size also influences water adoption of safe drinking practices, for example where the household uses boiling as a water safety measure, it is hard to boil a lot of

water continuously. People opt to spend money on more pressing needs such as buying charcoal for cooking rather than for boiling water. This increases chances of diarrhoea infections among children under five years.

Water storage can be influenced by knowledge people have around the same alongside household size for example the two settlements with low levels of education and big household sizes were poorer in full adoption compared to Manyani and Murogi. They stored water in wide mouthed containers undermining water safety and putting households at risk of diarrhoea diseases.

5.7 Conclusion

The following conclusions can be drawn from the findings

1. Structural variability across settlements, ease of access to an improved water source, interacting with households' socio-demographic have profound impact on households' water security, with consequent impacts on adoption of water safety practices. As a result households risk diarrhoea diseases in children under five years. The disease burden costs the family money confining the household to a cycle of urban poverty.
2. Water insecurity can be exacerbated by constraints of a household's water storage capacity. The less the water , the more there is none to de treated and at the same time poor to maintain hygiene such as washing water containers. So attention goes to obtaining the quantity and overlooks the quality making adoption of safe drinking water practices even harder to achieve. This increases chances of diarrhoeal infection in under-fives as a result of consuming contaminated water.
3. Slums with higher population densities in relation to the available water collection points, and also proximity of water kiosks, experience higher water insecurity. Water outside the premises is most often expensive. So under such circumstances people focus more on the more pressing household needs and neglect water safety and consequent risk of diarrhoea diseases in children under five years.

5.8 Recommendations

The findings of the study suggest the need for interventions on different aspects so as to improve water security and as a result increase the levels and sustainability of safe drinking water adoption in the informal settlements. As a result, Nakuru Municipality informal settlements' residents, especially women with children under five years, will improve their health by prevention of diarrhoea diseases. Devoting resources to proper functioning and maintenance of water infrastructure as well as water safety, could be more effective than managing bad health outcomes such as treating diarrhoea diseases.

There is need to come up with an integrated model that concerns good management of safe water supply and maintenance of water infrastructure. The researcher recommends a combination of Delegated Management Model (DMM) studied by Nzengya (2015) in Lake Victoria region and relational approach proposed by Corban and Karanja (2016). The local utility NAWASCO in this case can delegate management of infrastructure and service delivery to slum communities accompanied by consideration of other interrelated factors that affect water security and adoption of safe drinking water practices. This might be highly appreciated in the informal settlements that mainly have water sources from outside the premises. It would hasten sustained access to water services.

Public health education on safe drinking water practices is of essence in order to give the right information to the women on the methods of water treatment and especially the cost-effective one, water storage and handling so as to make adoption sustainable.

As the researcher went round the settlements, there was a general observation that all the houses were iron sheet roofed. Nakuru being a relatively rainy area, the county government could consider facilitating the households in obtaining water storage facilities that would enable them harvest rain water. This would improve water security and households would only remain with the task of treating water and therefore improve the adoption of safe drinking water practices.

5.9 Suggestions for future research

Based on the findings of this study, the researcher recommends the following areas for follow-up research:

1. A study could be conducted to come up with less expensive methods of making water Safe for drinking in order to promote more households to adopt safe drinking water practices.
2. Further research is needed to examine the effectiveness of the water treatment methods under varying practices of cleaning water storage container.

REFERENCES

Aigbiremelon O., Ike G., Momoh A., Lawal-Luka K., Abah O. (2015) Knowledge and Practice among Caregivers of under-five Children in a Rural Nigerian Community. *Public Health Research*.

Albarracín, D., Johnson, B. T., Fishbein, M., & Muellerleile, P. A. (2001). Theories of Reasoned Action and Planned Behavior as Models of Condom Use: A Meta-Analysis. *Psychological Bulletin*, *127(1)*, 142–161.

Bain, R., Cronk, R., Hossain, R., Bonjour, S., Onda, K., Wright, J., & Bartram, J. (2014). Global assessment of exposure to faecal contamination through drinking water based on a systematic review. *Tropical Medicine & International Health*, *19(8)*, 917–927.

Bartram, J., & Cairn cross, S. (2010). Hygiene, Sanitation, and Water: Forgotten Foundations of Health. *PLOS Medicine*, *7*(11).

Bartram, J., & Hunter, P. (2015). *Bradley Classification of disease transmission routes for water-related hazards*. Routledge Handbooks Online. https://doi.org/10.4324/9781315693606.ch03

Albarracín, D., Johnson, B. T., Fishbein, M., & Muellerleile, P. A. (2001). Theories of Reasoned Action and Planned Behavior as Models of Condom Use: A Meta-Analysis. *Psychological Bulletin*, *127(1)*, 142–161.

Corburn, J., & Karanja, I. (2016). Informal settlements and a relational view of health in Nairobi, Kenya: sanitation, gender and dignity. *Health Promotion International*, *31*(2), 258–269.

Drinking water | JMP. (2017). Retrieved May 28, 2018, from https://washdata.org/monitoring/drinking-water.

Gilbert, G. N. (Ed.). (2008). *Researching social life* (3rd ed). Los Angeles: Sage.

Hulland, K. R. S., Chase, R. P., Caruso, B. A., Swain, R., Biswal, B., Sahoo, K. C., … Dreibelbis, R. (2015). Sanitation, Stress, and Life Stage: A Systematic Data Collection Study among Women in Odisha, India. *PLOS ONE*, *10*(11), e0141883. https://doi.org/10.1371/journal.pone.0141883.

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A Decade Later. *Health Education Quarterly*, *11(1)*, 1–47.

Javadi, M., Kadkhodaee, M., Yaghoubi, M., Maroufi, M., & Shams, A. (2013). Applying Theory of Planned Behavior in Predicting of Patient Safety Behaviors of Nurses. *Materia Socio-Medica*, *25(1)*, 52–55.

Joshi, A. & Amadi C., T. (2013). Impact of Water, Sanitation, and Hygiene Interventions on Improving Health Outcomes among School Children. *Journal of Environmental and Public Health*. CUNY Graduate Center, 2013, 1-10.

Joshi, A., Prasad, S., Kasav, J. B., Segan, M., & Singh, A. K. (2014). Water and Sanitation Hygiene Knowledge Attitude Practice in Urban Slum Settings. *Global Journal of Health Science*, *6*(2), 23–34. https://doi.org/10.5539/gjhs.v6n2p23

Luby, S. P., Halder, A. K., Tronchet, C., Akhter, S., Bhuiya, A., & Johnston, R. B. (2009). Household characteristics associated with handwashing with soap in

Komarulzaman, A., Smits, J., & Jong, E. de. (2017). Clean water, sanitation and diarrhoea in Indonesia: Effects of household and community factors. *Global Public Health*, *12(9)*, 1141–1155.

Kothari. (2014). *Research methodology methods and techniques*. New Delhi: New Age International.

Mason, L. R. (2014a). Examining Relationships between Household Resources and Water Security in an Urban Philippine Community. *Journal of the Society for Social Work and Research*, *5(4)*, 489–512.

Mbugua, N. (2018, March 24). Why some families are poor and some prosper - Daily Nation. Retrieved May 27, 2018, from https://www.nation.co.ke/news/Why-some-families-live-in-poverty-and-others-in-prosperity/1056-4355648-13kleo6/index.html.

Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: quantitative and qualitative approaches*. Nariobi, Kenya: African Centre for Technology Studies.

Muhindi Susan. (2018). Beyond Zero campaign boost with US backing. Retrieved August 14, 2018, from http://www.the-star.co.ke/news/2018/06/16/beyond-zero-campaign-boost-with-us-backing_c1773624.

Nizame, F. A., Unicomb, L., Sanghvi, T., Roy, S., Nuruzzaman, M., Ghosh, P. K., Luby, S. P. (2013). Hand washing before Food Preparation and Child Feeding: A Missed Opportunity for Hygiene Promotion. *The American Journal of Tropical Medicine and Hygiene*, *89(6)*, 1179–1185.

Nzengya, Daniel M. 2015. "*Exploring the challenges and opportunities for master operators and water kiosks under Delegated Management Model (DMM*): A study in Lake Victoria Region, Kenya. 46:35-43.

Prochaska, J. O., & DiClemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice*. https://doi.org/10.1037/h0088437.

Prochaska, J. O., & Velicer, W. F. (1997). The Transtheoretical Change, 11.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social Learning Theory and the Health Belief Model. *Health Education Quarterly*, *15*(2), 175–183.

Satapathy, B. K. (2014). Safe Drinking Water in Slums, (24), 6.

Shaheed, A., Orgill, J., Montgomery, M. A., Jeuland, M. A., & Brown, J. (2014). Why "improved" water sources are not always safe. *Bulletin of the World Health Organization*, *92(4)*, 283–289.

Simiyu, S. (2016). Determinants of usage of communal sanitation facilities in informal settlements of Kisumu, Kenya. *Environment and Urbanization*, *28*(1), 241–258. https://doi.org/10.1177/0956247815616732

Stevenson, E. G. J., Greene, L. E., Maes, K. C., Ambelu, A., Tesfaye, Y. A., Rheingans, R., & Hadley, C. (2012). Water insecurity in 3 dimensions: an anthropological perspective on water and women's psychosocial distress in Ethiopia. *Social Science & Medicine (1982)*, *75(2)*, 392–400.

Subbaraman, R., Shitole, S., Shitole, T., Sawant, K., O'Brien, J., Bloom, D. E., & Patil-Deshmukh, A. (2013). The social ecology of water in a Mumbai slum: failures in water quality, quantity, and reliability. *BMC Public Health*, *13(1)*.

Tuyet-Hanh, T. T., Lee, J.-K., Oh, J., Van Minh, H., Ou Lee, C., Hoan, L. T., … Long, T. K. (2016). Household trends in access to improved water sources and sanitation facilities in Vietnam and associated factors: findings from the Multiple Indicator Cluster Surveys, 2000–2011. *Global Health Action*, *9*. https://doi.org/10.3402/gha.v9.29434.

UN - Water. (2018, July 6). Water and Sanitation. Retrieved August 14, 2018, from https://www.un.org/sustainabledevelopment/water-and-sanitation/

Vaishnavi Madhavan. (2015). *Principles of primary health care*. Health & Medicine. Retrieved from https://www.slideshare.net/vyshsedhu/principles-of-primary-health-care.

WSD - Water Safety Plans. (2017). Retrieved May 28, 2018, from https://www.wsd.gov.hk/en/core-businesses/water-quality/action-plan-for-enhancing-of-drinking-water-safety/water-safety-plans/index.html.

Zahanggir Alam, M., Alinur Rahman, M., & Abdullah Al Firoz, M. (2013). Water Supply and Sanitation Facilities in Urban Slums: A Case Study of Rajshahi City Corporation Slums. *American Journal of Civil Engineering and Architecture*, *1*(1), 1–6.

WSP (2014) Findings and Recommendations: PNG Sanitation, Water Supply and Hygiene in Urban Informal Settlements. World Bank Group.

World Bank Group November (2015) Unsettled: Water and Sanitation in Urban Settlement Communities of the Pacific. http://hdl.handle.net/10986/23336

Worrell, C. M., Wiegand, R. E., Davis, S. M., Odero, K. O., Blackstock, A., Cuéllar, V. M., … Fox, L. M. (2016). A Cross-Sectional Study of Water, Sanitation, and Hygiene-Related Risk Factors for Soil-Transmitted Helminth Infection in Urban School- and Preschool-Aged Children in Kibera, Nairobi. *PLOSONE*, *11*(3), e0150744. https://doi.org/10.1371/journal.pone.0150744

APPENDICES

Appendix 1: Letter of Introduction

I am Rosemary Wanyoike, a Master of Development Studies student at St Paul's University. I am conducting a research for academic purposes, in Nakuru Municipality taking three informal settlements namely Nyamarutu, Wamagata, Manyani and Murogi. The aim of my study is to explore household water security and adoption of safe drinking water practices among women with children under five years in Nakuru. I am inviting you to participate by responding to the list of questions related to the study. The findings of this survey will be shared with government and non-governmental agencies working in this area. They may use my findings to design interventions that will ensure the provision of consistent and safe water supply, adequate sanitation and hygiene facilities. I therefore humbly request you to spare some time and respond to the questions which I am going to ask you.

Do you agree? _____

I consent to participate voluntarily _____

(If Yes), thank you for agreeing to participate in this survey.

Appendix 1I: Questionnaire for mothers with children under five

Part I: Socio-demographics of the mother with children under five years

Age of woman (TICK ONE)	Marital status (TICK ONE)	**MAIN** Source of income (Tick ONE)	Highest level of education (TICK ONE)
18 yrs.- 25yrs 26 – 30yrs 31- 35yrs 36 – 40yrs 41 – 45yrs 46 – 49yrs 50 yrs. or older	1= Married 2= Single 3= Separated 4= Widowed 5= Divorced	1= **Mainly** Formal employment (specify) 2= **Mainly** Informal sources, small business, hawking domestic worker, other 3 = **Mainly** relies on Husband, or other for financial support	0= No **formal** education 1= Mainly Primary education 2= Mainly High school education 3= Holds a Certificate 4= Holds a Diploma 5= Holds a Degree

How many people live in this household (***that is, the number of people typically living in the home most days of the week***)? _____

Number of children five years and or/ below _____

Part II: Water accessibility

1) What problems (if any) have you, or members of your household been facing obtaining drinking water during the <u>past 30 days</u>?

_____?_____

2) What problems (if any) have you, or members of your household been facing obtaining for other domestic uses (cooking, bathing, washing clothes) during the <u>past 30 days</u>? ____

3) Water Sources for Drinking during the <u>PAST 30 DAYS</u>

4) Where have you, or members of your household, been collecting water for drinking during that <u>past 30 days</u>?

a) Piped water connected to the house

b) Piped to compound – Stand pipe

c) Water vendors

d) Borehole water located outside premises

e) Water kiosk located outside premises

f) Buys Bottled water

5) How would you describe the location of your MAIN piped water source during the past 30 days? (TCK ONE) [*Interviewer – verify please*]

- Piped water connected to house – used by members of household only
- Piped to compound – Stand pipe shared by several households
- Located Outside the house premises, for instance Water kiosk

b) How many **minutes / hours** does a trip from your house to the water source **and back**, take you? _____

c) Are there usually queues at the water sources? YES NO

d) If yes, about how many minutes doe one take queuing water to be served? _____

b) Approximately, how much money do you spend on buying water each MONTH?

c) Approximately, what is the total monthly income, from both formal employment (if any) and informal income activities for your household? _____

Part III: Water Insecurity

1 (a) In the past 30 days, did you worry that you would not have enough water for ALL your household needs? (Tick one) **Yes** ____ **No** ____

In the past 30 days, did you reduce the amount of water you used for:

- DRINKING because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- COOKING because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- WASHING UTENSILS because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- BATHING YOUR BABY / CHILD because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____

- CHILDREN'S CLOTHES because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- WASHING ADULT CLOTHES because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- WASHING HANDS because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- PREPARING FOOD FOR THE BABY / CHILDREN because there was NOT enough water or because it was too difficult to collect water? **Yes** ___ **No** ___
- WASHING HANDS because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- WSHING DISHES FOR CHILDREN / BABY because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____
- CLEANING HOUSE because there was NOT enough water or because it was too difficult to collect water? **Yes** _____ **No** _____

1) A) In the past 30 days, did you or anyone in your household drink water you thought might not be safe for health? **Yes** _____ **No** _____
2) In the past 30 days, did you or someone in your household NOT cook a desirable food because there was not enough water? **Yes** _____ **NO** _____
3) If the household contains male-school pupil, in the past 30 days, did any boy children in your household who is a pupil, go to school late or stay home from school to help with water collection? **Yes** _____ **No** _____
4) If the household contains female-school pupil, in the past 30 days, did any boy children in your household who is a pupil, go to school late or stay home from school to help with water collection? **Yes** _____ **No** _____
5) In the past 30 days, did you or anyone else in your household sleep very few hours because they wake up very early in the morning to go for collecting water? **Yes** _____ **No** _____
6) "Within the past 30 days, was there any time that you did not collect water when you wanted to"? **Yes** _____ **No** _____

[If NO, go to 19; if YES, was it because….

b) It was too far away / takes too long to get there? **Yes** _____ **No** _____

c) It was too risky / dangerous for life? **Yes** _____ **No** _____

d) takes too long to wait at source / queue too long? **Yes** _____ **No** _____

e) Not enough water at source? **Yes** _____ **No** _____

f) Was too sick or weak to collect water? **Yes** _____ **No** _____

g) Baby or child was unwell? **Yes** _____ **No** _____

h) Had taken sick baby of child to health clinic / hospital? **Yes** _____**No** _____

i) Had NO-ONE to leave baby or child with? **Yes** _____ **No** _____

7) In the past 30 days, did you collect water from undesirable or dirty water from a neighbor? **Yes** ____ **No**_____
8) In the past 30 days, did you because of a lack of water at home take water from a neighbor? **Yes** _____ **No** _____
9) In the past 30 days, have you had a quarrel with a neighbor or other person related to water? **Yes** _____ **No** _____
10) [If married], in the past 30 days, have you had a quarrel with your spouse about water needs of your household? **Yes** _____ **No** _____
11) In the 30 past days, did you go a whole day without drinking water because there was not enough water? **Yes** _____ **No** _____
12) [If married] in the past 30 days, have you had a quarrel with your spouse about completing daily work? **Yes** _____ **No** _____
13) In the past 30 days, did you not participate in church / not call someone who was ill, or not attend a funeral, wedding, or women's meeting or social event when you wanted to because of water collection duties? **Yes** _____**No** _____

Part IV: Water safety knowledge and practices

1 a) What method do you use to make water safe? _____

b) If you do NOT treat water for drinking, what is the reason? _____

c) What do you use to store drinking water? _____

d) Why do you prefer storing drinking water using this method? _____

e) In a typical day, what is the maximum amount of water that you store in your household? _____

b) If you DON'T have a large container to store water for domestic use for your household, what is the main reason, is it because _____

Appendix 111: Research Authorization Letter



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/23994/21311**

Date: **21st February, 2018**

Rosemary Gathoni Wanyoike
St. Pauls University
P.O. Private Bag - 00217
LIMURU.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"House hold water security and adoption of safe drinking water practices among women with children under five years,"*** I am pleased to inform you that you have been authorized to undertake research in **Nakuru County** for the period ending **20th February, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Nakuru County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GP Kalerwa
GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nakuru County.

The County Director of Education
Nakuru County.

National Commission for Science, Technology and Innovation is ISO9001:2008 Certified

Appendix IV: Research Permit

THIS IS TO CERTIFY THAT:
MISS. ROSEMARY GATHONI WANYOIKE
of ST. PAULS UNIVERSITY, 2612-20100
Nakuru,has been permitted to conduct
research in *Nakuru County*

on the topic: *HOUSE HOLD WATER SECURITY AND ADOPTION OF SAFE DRINKING WATER PRACTICES AMONG WOMEN WITH CHILDREN UNDER FIVE YEARS*

for the period ending:
20th February,2019

.....
Applicant's Signature

Permit No : NACOSTI/P/18/23994/21311
Date Of Issue : 21st February,2018
Fee Recieved :Ksh 2000



.....
Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. The License is valid for the proposed research, research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
4. The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.
5. Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.
6. This Licence does not give authority to transfer research materials.
7. The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.
8. The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No.A 17603

CONDITIONS: see back page