ASSESSMENT OF SANITATION ACCESS AND ITS EFFECTS ON HOUSEHOLD'S LIVELIHOODS IN MATHARE SLUMS, NAIROBI COUNTY, KENYA

BY

Cosmas Wambua Mang'uu

This dissertation is submitted in partial fulfilment of the requirements for the award of a Master of Development Studies (MDS) from St. Paul's University.

AUGUST, 2018

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DECLARATION

This thesis is a product of my own work and is not the result of anything done in collaboration. It has not been previously presented to any other institution. I agree that this thesis may be available for reference and photocopying, at the discretion of the College.

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RECOMMENDATION

"I declare that the work reported in this dissertation was carried out by the student under my supervision"

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DEDICATION

Dedicated to my wife, Liz and our three sons, Isaac, Johnpaul and Shalom.

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ABSTRACT

Access to improved sanitation is one of the aspects that sustain good health, better standard of living and a key strategy to poverty alleviation. However, one-third of the world population, estimated to about 2.3 billion continue to miss on these benefits, with over 892 million having no sanitation facility at all. Majority of them are from Sub-Saharan Africa, with high poverty levels, who continue to bear the heavy burden of sanitation-related diseases, leading to perpetual vulnerability and loss of the limited households' income owing to frequent medication and hospitalization. Thepurpose of the research was to find the current households sanitation access in Mathare slums, to assess the knowledge and practice gaps on sanitation and to establish the social-economic effects of poor sanitation to households' livelihoods in the study area.Descriptiveresearch design wasused in this research while stratifiedand random sampling wereused for sampling. A sample size of 155 respondents/ household heads was selectedfrom the sample frame of about 50585 households. The researcher used questionnaires, interview and observations for data collection and a mobile data capture platform (Kobocollect) wasutilised.The collected data wasanalysedusing Microsoft Excel and the Statistical Package for Social Science (SPSS). The key findings of the study are: the average household's sanitation accessfor the four wards is50%, withanother 45% using public toilets, while 4% borrowed from neighbours, and1% used buckets or paper bags; access to toilets (pour flush and water closets) was at 44% while sewer connection was at 40%;majority of the households had some background knowledge on the connection between diarrhea and general hygiene and sanitation, although some knowledge and practice gaps on the causes of diarrhea and practices to prevent such as use of toilets and water treatment where found. The low sanitation access coupled with knowledge and practices gaps was found to have a significant impact on household's livelihoods. Economically, households were found to spend part of their income to access sanitation in public toilets, and also to cater for medications due to frequent diarrheal related ailments. Sanitation-related morbidity and mortality also impacted on household's productivity and loss of income opportunities. Poor sanitation also exposed household members, mainly girls and women to rape, theft and physical injuries as well as poor quality of life and standard of living.

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LIST OF ABBREVIATIONS

APHRC	African Population and Health Research Centre
AWSB	Athi Water Services Board
ESH	Environmental Sanitation and Hygiene
FAO	Food and Agricultural Organization of the United Nations
GOK	Government of Kenya
JMP	Joint Monitoring programme
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KAP	Knowledge, Attitude and Practice
MDGs	Millennium Development Goals
NCWSC	Nairobi City Water and Sewerage Company
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
UNICEF	United Nations Children Fund
UN	United Nations
UNDP	United Nations Development Programme
UN-Habitat	United Nations Human Settlements Programme
WASH	Water, Sanitation and Hygiene
WASREB	Water Services Regulatory Board
WHO	World Health Organization

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CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter presents the background information and the overview of theresearch. In this research, the author intended to assess sanitation access and how itimpacted on household's livelihoods in Mathare slums in Nairobi County. The chapter has the introductory section with the study background, followed by the Statement of the Problem, Purpose of the Study, the Study Objectives, Research Questions and the hypothesis, significance of the study and definition of key terms. The limitations and delimitations of the study are also highlighted in this chapter.

1.1 Background of the Study

The Sustainable Development Goal (SDG) no. 1 is aimed at aworld with its people, including those in extreme poverty and the most vulnerable, to enjoy a basic standard of living and social protection benefits by the year 2030(UN, 2016, p. 3). Sanitation access is one of the vital aspects that sustain a good standard of living,for "It contributes to better human health, dignity and quality of life" according to (GOK/MOH, 2016). Access to improved sanitation, complemented withaccess to safe water and proper hygiene, contributes significantly to good health and livelihoods and lack of good health is closely linked to poverty(Hussain et al, 2002).

Inadequate access to water, sanitation andhygiene (WASH)has been estimated to cause nearly 1.7 billion cases of diarrheal diseases annually, across the globe, resulting in about 2.2 million deaths, mostly children in developing countries(WHO, 2013).Summing up the multiple effectson public health, WHO estimatedthat unsafe

Water, Sanitation andHygiene (WASH) was responsible for nearly one-tenth of the global disease burden, (Prüss-Üstün et al, 2008).In Kenya, about 80% of hospital attendance has been found to be as a result of preventable ailments, with 50% of these diseases related to poor sanitation and hygiene (GOK/MOH, 2007). This disease burden is mainly borne by the poor, owing to unsafe drinking water, limited sanitation infrastructure and poor hygienic practices (Jacob et al, 2010).World Health Organization(WHO) studies carried out in early 1990s indicated that the median reduction in morbidity for diarrhea, trachoma, and ascariasis induced by sanitation and/or water supplies was 26%, 27% and 29%, respectively, while those for schistosomiasis and dracunculiasis was at 77% and 78%, respectively (Esrey S.A. et al, 1991). Further also, systematic reviews have shown that improvements in access to sanitation and water can result in a 20 – 40% reduction in diarrhea burden among children less than five years (OECD, 2011).

The Sustainable Development Goal (SDG) on Water, Sanitation and Hygiene endorsed in 2015 committed the countries of the world to achieve a universal access of "ensuring availability and sustainable management of water and sanitation for all" (UN, 2015 Goal No. 6). The Sustainable Development Goal (SDG) No. 6 is a major improvement to MDG goal No. 7 according (ICSU, 2015), One of the major improvement being the inclusion and monitoring of hygiene practices (such as handwashing with soap and menstrual hygiene management) and WASH access beyond the household setting (schools and health care facilities)(UNICEF/ WHO, 2015).

Report by (WHO/UNICEF, 2017)on progress on sanitation indicated that 2.3 billion people had no access to basic sanitation services with 892 million practicing open defecation and another 856 million using unimproved sanitation facilities such as pit latrines without a slab or platform, hanging latrines or bucket latrines. The report further indicated that about 600 million who had improved sanitation facilitiesshared with other households therefore classified as having a limited access to sanitation services. On global progress towards universal access by 2030, (WHO/UNICEF, 2017) indicated that "no SDG region was on track to achieve universal basic sanitation by 2030, with the exception of Australia and New Zealand, where coverage is already nearly universal".

A report on sanitation access in Kenya released in June 2015 reported that 57% of Kenyans used improved or shared sanitation facilities (79% in urban areas and 49% in rural areas) while 12-14% had no access to sanitation facilities and were still practicing open defecation (3% in urban areas and 15% in rural areas) (UNICEF/WHO, 2015). Poor sanitation access mainly affects the poor population, according to (Wasonga et al, 2014) living in the informal settlements, peri-urban and rural areas, where open defecation practices, lack of improved sanitation services and use of unsafe water persists, knowledge gaps, which hinder them from practicing basic hygiene. This condition has led to high prevalence of diarrhea and other sanitation-related diseases. For instance, a study carried out by African Population and Health Research Centre (APHRC, 2002) showed that the prevalence of diarrhea among children below the age of 3 was around 40% in Kibera slums, whereas it was much lower in Nairobi as a whole (13%) and at national level in Kenya (17%).

In sub-Saharan Africa (SSA) region, the progress towards achieving universal access to improved sanitation is still low. For instance, in terms of reducing open defecation, (WHO/UNICEF, 2017)reported that the population practicing open defecation increased from 204 million to 240 million from 2000 -2015. Overall, sixteen of the 24 countries had at least one in five persons having limited sanitation services (facilities shared by more than two families), especially in urban areas. This regional trend in sanitation accessis mainly influenced by the challenge of rapid population growth(WHO/UNICEF, 2017),coupledwith high, uncontrolled urbanization estimated to 1.2- 5% annual growth, which has led to increase in slums populations(UN-Habitat, 2006).The resulting phenomenon has created a huge pressure on the existing basic urban services such as water and sanitation access. Another key factor influencing sanitation access in the region is linked to social-cultural and economic marginalization based on aspects, such as ethnicity, religion, economic class, social status, gender, age or physical abilities which limit people from accessing land and water resources and related services (WWAP, 2015). Such exclusion creates a long-term vulnerability with both social and economic effects, leading to perpetual poverty.(UN-Habitat, 2008) Notes that improvements in water and sanitation access is probably the most important factors in poverty and inequality reduction especially in urban areas.

One key reason why sanitation access has remained low despite many national and international programs is the low profile on sanitation compared to other services such as water (IRC, 2007). The reasons for low profile according to (IRC, 2007) include lack of collective aspirations to improve sanitation in rural and low potential urban areas

resulting to low demand for sanitation services(Scott and Govindan, 2003), distrust on the sanitation services (public or private) due to sub-standard services provided especially to the poor, low return by providers of sanitation services compared to other services such as water making sanitation business unattractive (Crennan and Berry, 2003), low financial allocation for sanitation services development, and weak policy and institutional framework resulting to low action on the ground (GOK/MOH, 2016), SACOSAN, 2003, (IRC, 2007).

Governance issues are also noted to be a major challenge facing the sanitation sector. Some of the governance challenges facing sanitation development in sub-Saharan Africa according to (Nelson Ekane, 2014) include: weak co-ordination mechanisms among key stakeholders, poor integration of water, sanitation and hygiene issues(WaterAid 2011), research gaps, inadequate commitment and actual expenditure in the sector (UN-Water and World Health Organization 2012), supply and technology driven interventions rather than demand, capacity and knowledge gaps on sanitation and hygiene,weak institutional and legal frameworks, lack of focus to the urban poor (cited from Nyonyintono Lubaale and Musembi Musyoki 2011) and unsustainability of sanitation interventions (in Ekane et al. 2012; Ekane and Gill 2013). The other major bottleneck is the lack of capacity to translate policies to real practice owing to socio-cultural and economic factors which shape prevailing behaviour and practice(Nelson E et al, 2016). In Kenya, institutional fragmentation, coordination issues and low fiscal allocations has been noted as some of the main challenges facing the sanitation sector (GOK/MOH, 2007).

Mathare Slums is the second largest Informal settlement in Nairobi city, characterized ofwidespread overcrowding, social and economic marginalization, poor environmental conditions, insecurity and near absence of basic social services,(APHRC, 2014); High poverty levels, with incomes estimated to between Ksh. 3,000 (NCWSC/AWSB, 2009)and Kshs.8,500, with over 30% earning less than Ksh. 5,000((MUST, 2011); Over-urbanization due to rapid population growth,shortage of affordable, decent housing and uncertain land tenure attributed to the illegal nature of slums settlements, further shrinks the incentive to improve the surrounding leaving the urban poor almost excluded from governments' development and service delivery plans such as water and sanitation services, (Abdulla et al, 2011). The study is focused on 4 wards in Mathare slums namely Mlango Kubwa, Ngei, Hospital ward and Mabatini.

1.2 Statement of the Problem

Inadequate access improved sanitation and poor hygiene isstill a major problem in Kenya, especially in rural and urban informal settlements. Sanitation infrastructure deficits coupled with knowledge and practices gaps have been found to cause over 50% hospitalizations in Kenya according to(GOK/MOH, 2007). The gaps still exist, despite the Government of Kenya and other stakeholders' plan to have achieved the MDG goals by 2015, which aimed at ensuring that all households were "sensitized to the importance of improved environmental sanitation and hygiene (ESH) practices for improved health; and that 90 percent of households had access to a hygienic, affordable and sustainable toilet facility, used safe drinking water and safely disposed of waste products''(GOK/MOH, 2007). Poor sanitary situations are mainly foundin the informal settlements and rural areas, which also experience dire socio-economic conditions and

high incidence of poverty. A study carried out in Mathare area by (MUST, 2011)indicated thatonly 17% of residents had access to a household (private) toilet, while another 29% of households lived within 30 meters of a functioning public latrine block.

The government of Kenya and the ministry of health in the development of new sanitation and hygiene policy, “Kenya Environmental Sanitation and Hygiene Policy-2016-2030” had identified serious bottlenecks which continue to face the sanitation sector. Key among them include low sanitation priority in the national development agenda and hence low national budgetary allocations, institutional fragmentation due to inadequate multi-sectoral coordination mechanisms, low operational and technical capacity and weak research and development systems(GOK/MOH, 2016).These challenges continue, albeit the country’s plan to achieve Kenya’svision 2030 and the global Sustainable Development Goals (SDGs), which envisions “a newly-industrialized, middle-income country providing a high quality of life to all its citizens in a clean and secure environment”(GOK/MOH, 2016) and “a universal access to sanitation for all by 2030”(UN, 2016) respectively.Monitoring the progress towards the realization of these goals is,therefore vital. Many studies have been carried out within the study area, mainly focusing on water, planning issues and some on sanitation and livelihoods. This study is significant because it will provide data on access to sanitation after the end of a global programme, the MDGs and also provide baseline data, for the SDGs and it targets one of the biggest informal settlement in Kenya.

The problem to be addressed by this research is, to assessthecurrent sanitation access data for Mathare slums, to assess the knowledge and practice gaps on sanitation and to determinetheeffects of the current sanitation access on households in Mathare slums.

1.3 Purpose of the Study

The main purpose of the study is to assess the current sanitation access and its effect onhousehold's livelihoodsin Mathare slums, Nairobi County.

1.4 Objectives of the Study

The following are the specific objectives of the study:

1. To assess the currentaccess to sanitation facilities in Mathare slums, Nairobi County, Kenya,
2. To assess the knowledge and practices gaps on Sanitation in Mathare slums, Nairobi County, Kenya,
3. To assess the households perception of the effects of poor sanitation to their livelihoods in Mathare slums, Kenya.

1.5 Research Questions

The research will attempt to answer the following questions;

1. What is the current access to sanitation in Mathare slums, Nairobi County, Kenya?
2. What are the knowledge and practices gaps on sanitation in Mathare slums, Nairobi County, Kenya?
3. What are the household's perceptions of the effects of poor sanitation to their livelihoods in Mathare slums?

1.6 Significance of the Study

Poverty is considered as an “outcome of complex interactions of resources, institutions, actions and strategies and their ultimate outcomes” (Hussain et al, 2002). Since sanitation is one these resources/assets upon which poor people useto support livelihoods, understanding the linkages between the sanitation and livelihoods is a great step towards poverty alleviation and in establishing sustainable livelihood strategies. The study will try to establish the socio-economic effects of poor sanitation access at the household level. The outcomes of the study will contribute to deeper understanding on how sanitation and Hygiene (S&H) interventions should be designed and how they can effectively integrate to other poverty alleviation strategies. The study is mainly significant to central government agents, devolved units, the private sector, and especially those involved in the provision of sanitation and hygiene services and those championing the rights of the poor. This will enable them to develop pro-poor initiatives aimed at empowering the urban poor and slums dwellers to mitigate the existing situations.

1.7 Limitations of the Study

The study faced the following limitations:the study location is an informal settlement where the majority are poor / have low-income levels. A number ofrespondents were non-responsive and often demanded for a pay to be interviewed. Further, due to the low literacy level of the respondents, some of them were unable to answer questions from the questionnaire, which required translation to Swahili or some local dialect. In some cases, the questionnaires were filled incorrectly, which required thorough data cleaning. Movement through the slumswas also impairedby insecurity and

inaccessibilitywhichnecessitated the support and escorts by village heads and representatives from the provincial administration.

1.8 Delimitation of the Study

Mathare slums is a vast settlement, overly congested and densely populated, with over 50,000 households. The research was delimited in scope since only a sample of households could be sampled. Nevertheless, triangulation approach was adopted to cross-check and also to obtain additional information that relates to the subject of research.This included obtaining sanitation monitoring data through permission from Nairobi City County, Directorate of sanitation from key informants such as public health officers and medical health facilities in the area. The research is delimited to Mathare slums hence the results and the recommendations should be applied with caution to other informal settlements in Nairobi and in Kenya.

On the other hand, livelihood is avery broad term. For the purpose of this study, the term livelihood is delimited to those issues related to sanitation such as health indicators, households' income and expenditure on sanitation.

1.9 Definitions of Significant Terms

1.9.1 Access to improved sanitation facilities: according to (WHO/UNICEF, 2017) include limited access, basic access and safely managed sanitation facilities, where access to improved sanitation facilities that are shared is termed as limited access; access to improved sanitation facilities that not shared is basic

access;and access to improved sanitation facilities where excreta is fully managed are called safely managed sanitation access.

1.9.2 Access to an improved water source: "is the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as piped water into a dwelling, plot, or yard; public taps or standpipe; tube-well or borehole; protected dug well or spring; and rainwater collection" (World Bank, 2013)

1.9.3 Informal settlement/ Slums: As defined by the (UN-Water, 2006), a slum is an inhabited area in towns or cities, which are poorly planned,with limited or lack access to proper and adequate basic services such as water, sanitation, security, permanent and adequate structures and sufficient living space.

1.9.4 Knowledge are *set of understandings, one's capacity for imagining, one's way of perceiving and knowledge of a health behaviour*(Sybille G, 2011) which an individual or a community consider to be beneficial, for instance, knowledge of faecal- oral contamination of water;

1.9.5 Livelihoods: in simple terms are the capabilities, the assets(including both material and social resources) and activities required for a means of living (Chambers & Conway, 1991).

1.9.6 Poor: The basic meaning is the state of being unable to meet one's basic needs due to low income.

1.9.7 Poverty: it's defined as the inability of getting choices and opportunities, a violation of human dignity (Mokomane, 2012). In terms of income, extreme poverty refers to the persons who live on less than $1.25 a day (UNDP, 2015)

1.9.8 Practices are the noticeable actions of an individual/ community in response to a situation such as use of latrines, treatment of water or handwashing with soap in response to a cholera outbreak (Sybille G, 2011).

1.10 Organization of the study

Chapter one provides the background information on the study showing the global, regional, and national dimension of the phenomenon under study. It highlights the gaps the study is made to fill and the importance of this study. The chapter identified the objectives, research questions and the significance of the study as well as the constraints identified during the study.

Chapter two presents a review of the available literature regarding the research topic so as to give a better understanding of the study. The chapter also highlights the theoretical framework guiding this research and the conceptual framework to show how independent variables relate to dependent variables.

Chapter three presents the methods and techniques that the researcher used to collect primary and secondary data relevant to the study. The chapter describes the design used in the research, target population, the sampling methodology and measures taken to ensure validity and reliability in the research. Data analysis techniques used are also highlighted.

Chapter four presents analysis, presentation and interpretation of data under the following thematic areas; level of access to sanitation at household levels, knowledge and practices on sanitation and hygiene, economic effects of sanitation, health effects of

sanitation access,impact of sanitation access on household's livelihoods and the linkages to poverty in Mathare slums.

Chapter fiveprovides a summary of the study findings followed by conclusion based on the results and findings in of chapter four. The recommendations and suggestions for further research based on the above conclusion are also highlighted in this chapter.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter presents an in-depth review of various studies and the available literature that has been reviewed for this research. The reviewed literature focuses on the Sanitation and livelihood linkages,review of the role of sanitation and hygiene policies, Sanitation linkages to health, Theoretical framework and the conceptual framework of the study.

2.1 Literature review on sanitation and livelihood linkages

Sanitation access (together with Water and hygiene) plays a key role in "relation to human health, livelihoods, economic growth as well as in sustaining ecosystems" as declared by International Conference on Freshwater declarations held in Bonn in 2001 (Reba, 2003). Poor access to water and sanitation has an effect on health, productivity and physical safety of the poor, Reba (2003).There are several approaches to defining livelihood. For instance, (Chambers and Conway, 1992) defined livelihood as:

> A livelihood comprises people, their capabilities and their means of living, including food, income and assets. Tangible assets are resources and stores, and intangible assets are claims and access. A livelihood is environmentally sustainable when it maintains or enhances the local and global assets on which livelihoods depend, and has net beneficial effects on other livelihoods. A livelihood is socially sustainable when it helps cope with and recover from stress and shocks, and provide for future generations"(IRC, 2007).

Livelihoods in this case are activities that enhance poor people's means of living including income-generating activities that bring cash income or able to generate in-kind products that add to the monetary income of the households and/or reduce

expenditures(IRC, 2007).Building from above definition, IRC thematic overview paper on "Enhancing Livelihoods through Sanitation" (IRC, 2007) defines livelihood as people's means of survival, which can be affected by the situation in which they find themselves, especially their physical, economic, social, environmental and psychological conditions. Livelihoods in this approach are able to produce income which contributes to improving life conditions and enhancehuman dignity, can improve family members' health and the immediate environment.

Another approach to livelihoods is the Sustainable Livelihoods framework, which takes an integrated view of how livelihoods are created by integrating the micro-economy of the individual or household with the macro-level institutional, policy and vulnerability contexts in which they are situated, Ellis & Freeman (2005), Jensen (2009). This approach puts emphasis on the need to understand the poor. For instance, the UNDP Sustainable Livelihood Approach (SLA) endevours to addresses people in their local context to create an enabling environment so that men and women can optimally use what they are capable of using and let their capabilities flourish (UNDP, 1999) (IRC, 2007).

(IRC, 2007) suggests a two-way relationship between sanitation access and livelihoods. On one way, sanitation is said to bring a positive impact on the livelihoods of the poor. "Improved sanitation makes its possible for poor women and men to undertake initiatives and mobilise their assets". On contrally, lack of improved sanitation makes the poor susceptible to water borne diseases hindering them from enganging in productive works. This thought is supported by (WWAP, 2015) study, which deduced

that lack of improved sanitation (and water) often leads to recurrent diarrheal and other life-threatening water-related diseases, leading to perpetual weakness and loss of income due to frequent medication and hospitalization. Consequently, poor access to sanitation, in this case, limits the freedom of choice between paying for water, food, school fees or medicines (WWAP, 2015). On the other side of the coin, improved livehoods also enhance improved sanitation by the households. Households with more disposable income are able to make improved sanitation a relevant goal to be achieved through their own efforts and or with minimal help (IRC, 2007).

IRC thematic overviw paper also paper proposes a broader model that considers the whole sanitation value chain where the poor is involved. i.e disposal of human waste, collection, treatment, transfer, re-use, coverage and management of human excreta. Human waste can be utilsed as an asset/ input in productive activities such as agriculture (IRC, 2007) and production of energy. In this model, household's livelihoods can benefit both directly or indirectly, through activities which generate income for instance eco-sanitation which produces fertilizers or benefiting from support such as training to enable them choose the sanitation infrastructure they need, which will eventually bring higher levels of health and hygiene (IRC, 2007). A study by Practical action in Maili Saba slums focusing on livehood and gender on sanitation, hygiene and water services found out that Water and sanitation services offer business opportunities community members/groups employed in managing toilet blocks.

Another line of though suggest that Sanitation and livelihoods tend to be linked through the impacts of poor facilities on health, safety and time (Practical Action, 2005). Un-

improved latrines in urban informal settlements often lead to contamination of water sources leading to high incidence of diarrhea.Interms of gender perspectives on public sanitation, (Practical Action, 2005) study found out that women were constrained from using improved sanitation facilities e.g. community because of financial aspects related to subscription to use the sanitation block; time spend to walk and queue for public sanitaton blocks and safety concerns for fear of attack and rape. This is also supported by (Joanna P. & Kate M, 2008) Paper on non-health benefits of sanitation which examines the gender, education, disability, economic and environmental implications of sanitation. Improved sanitation at household's level is noted to have time and energy savings effect on women, bringing benefits such as more time for child care, improved domestic hygiene, increased rest time and community development work. Economically the paper notes that sanitation can be a means to empower women, especially those in direct management of sanitation facilities for roles such as operators and committee members.

UNICEF (2003) in SuSanA(2009) study also linked lack of improved sanitation access to poor access to education. This study found that many children, especially girls miss educational opportunities because they are forced to be late or miss school to help their mothers to fetch water. In rural Pakistan, for instance, the study found out that more than 50% of girls drop out of school in grade 2-3 because the schools do not have latrines SuSanA (2009). An evaluation of an intervention carried out by UNICEF Bangladesh in 1994 found that the number of girls increased by 11 per cent in a class of 228.(Joanna P. & Kate M, 2008). A related research by OECD (2011) projected that reduction of diarrhea by meeting the sanitation MDG target would have added more than 200 million

days of school attendance per year, leading to increased female literacy. Increased education of girls, in this case, would have had an impact to the economic growth, according to UNICEF in OECD (2011), which argued that in a typical developing country, for every 1% increase in female secondary schooling results in a 0.3% increase in economic growth (Bartram, 2008).In regards to disability, installation of disabled friendly facilities such as handrails, paths and possibly, toilet seats increased school's enrolment by 113 per cent of disabled children over a three-year period in Kenyan schools (cited from Bannister et al., 2005) in(Joanna P. & Kate M, 2008). Installation of toilet set was also noted have a time saving effect for both the disabled and the caregiver.

Several other studies also linked sanitation access to household's livelihoods and poverty. For instance (WWAP, 2015), indicated that poverty levels influence the type of sanitation facilities owned by the household. This is because the cost of building a latrine can be prohibitive, in relation to household income in many rural/suburban communities, especially in areas with unstable soil condition, in rocky or high-water tables. Sanitation development strategies in this case, should, therefore, consider households income and livelihoods. In this regard, (WWAP, 2015)reasoned thatpoverty-reduction approach to water, sanitation and hygiene promotion could impact positively the lives of billions of poor people, because of the very direct benefits accrued from improved sanitation services through better health, reduced health costs, increased productivity and time-savings.MOH/GOK(2007), also noted that improvement in sanitation and hygiene is significant in poverty alleviation, through jobs creation,

utilization of local resources, improved health and hence increased productivity, skills development and hence the provision of long-term livelihoods.

Poverty-reduction approaches in Water and sanitation was also highlighted by Alan Nicol (1999), as an integration which pays a close attention to the link between water/ sanitation supplies and urban and rural livelihoods. This concept proposed the need to integrate poverty eradication into the water and sanitation sector; to address poverty as a livelihoods issue affecting individuals, households and communities. This concept goes beyond evaluating the health benefits of improved water, sanitation and hygiene, but also looking keenly to the establishment of sustainable livelihoods through WASH interventions. This concept proposed key areas of focus such as time-savings and their economic impact at a household level (Churchill, (1989, (Alan Nicol, (1999).

The concept of Poverty-reduction approach to water, sanitation and hygiene promotion was similarly supported by UN-Water report in the United Nations World Water Development Report, (WWAP, 2015), which closely linked Water, Sanitation and Hygiene (WASH) and economic development. According to the report, improved WASH management can contribute to poverty reduction strategy in four dimensions: firstly through enhanced livelihoods security; secondly through reduced health risks resulting from waterborne diseases, such as diarrhea and water-related vector-borne diseases like malaria, thirdly by reducing vulnerability from unsustainable environmental trends and shocks from water-related natural disasters and finally by through economic growth resulting from WASH-related income-generating and business opportunities.

Sanitation relationship to livelihoods was also supported bySullivan et al, (2003) where they related poverty, sustainable livelihoods and water poverty index/ sanitation index. Poverty, in this case, is referred to as a deprivation of one or more basic conditions or skills needed for effective living. Lack of access to safe water and improved sanitation according to this concept have a bigger impact on health as well as economic productivity, in relation to time lost in the search for water and sanitation. In relation to sustainable livelihoods framework by (Scoones, 1998, Carney 1998), Sullivan et al, (2003) development (in this case WASH interventions) should have an impact on livelihood assets or capitals in term of natural, physical, financial, social and human assets.

2.2 Role of sanitation and hygiene policy in sanitation access

Sanitation Policies, according to (Elledge M, 2003)are important instruments whose purpose is to "create an enabling environment" for improving access to sanitation and hygiene services. This is primarily because they provide a political goodwill at the highest level, supported withthe necessary budgetary allocations and the required legal framework (Nelson E et al, 2016). Policies,also stimulate action by incorporating local initiatives in the overall strategy, though defining priorities and also for creating the conducive conditions in which sanitation services can be improved. Further, sanitation policies "sets the scene for more sustainable and effective programmes", as they are an expression of commitment and help to articulate priorities and allocate resources for implementation. Finally, sanitation policies, according to (Elledge M, 2003) play the role of modeling the incentives as they guide and challenge programmers and

organizational actors on the need to maintain the balance between the policies and project activities.

Many countries, especially in Sub-Saharan Africa (SSA) and Asia have been said to lack comprehensive sanitation and hygiene policies (Elledge M, 2003), and where they exist, they are firstlyunclear and inconsistent (Morella, E. (2008) in (Nelson E et al, 2016). Secondly,most of the available policies are never implemented into real interventions.Thirdly, according to Galan et al. (2013), (Nelson E et al, 2016) is the challenge of low budgetary provisions to support these policies, hence resulting to very little activities on the ground. Another key obstacle according to (Nelson E et al, 2016)is related to institutions and societies, where policies gaps exist at different levels and lack of understanding on how to address them at each level.

A Sanitation and hygiene policy, according to (Nelson E et al, 2016) shouldadequately addresscertain key factors or elements so as to provide the required enabling framework for effective action. These factors include: clearly define the roles and responsibilities of different actors; identify and state the target group(s); highlight the human and environmental health implications; back up the legal framework with the proposed actions and implementation plans; and finally, support the visions and ambitions of the organization with financial commitments. The review of Kenya's sanitation and hygiene policies in this research is therefore guided by these five keys factors.

The Environmental Sanitation and Hygiene Policy (2007)

The Kenya Environmental Sanitation and Hygiene Policy 2016-2030 and its predecessor, theEnvironmental Sanitation and Hygiene Policy (2007) is the primary policy which governs the provision of sanitation and hygiene services in Kenya. Under the policy, the Ministry of Health is mandated with the overall responsibility for policy and strategy, research, regulation, supervision and coordination while the actual services are provided by various others actors. For instance, water-borne sanitation is provided by Water Services Boards (WSBs) and Water Service Providers (WSPs) under the Ministry of Water and Irrigation while onsite sanitation is provided by other departments such as Ministry of Education (school's sanitation) and County governments, who are responsible for formulating necessary by-laws to guide the implementation of sanitation services within the urban areas/counties. The policy identified varied stakeholders, including relevant government ministries/departments (Ministry of water and irrigation, the ministry of education and county governments), donor and UN agencies, national and International NGOs, private and CBOs among others.

The Environmental Sanitation and Hygiene Policy (2007) was developed to address some of the gaps which existed at the Sanitation and hygiene sector. One of thesegaps was the weak institutional framework and capacity for supporting national sanitation and hygiene development. According to Kirimi (2009), the sector hadserious gaps which inhibited coordination and sustainability of sanitation and hygiene programs at the national level. IEA (2007)also noted that the existing laws such as the Water Act 2002, which mandatedagencies such as WSBs and WSPs to provide water, sewerage and sanitation, the sewerage and sanitation components were mostly ignored and grossly unfunded, consequently leaving the burden of sanitation and sewerage development,

mainly to communities or individual households. GTZ(2008)further argued that, Water Act 2002 failed to adequately address the issue of sanitation, in that it only considered water-borne systems while on-site sanitation, was left out to the Ministry responsible for health, and /or local governments.

The other key gap was related to underfunding in that (GOK/MOH, 2007) noted that Environmental Sanitation development was ranked low in the National development agenda MOH/GOK(2007)hence grossly underfunded. A key observation by the policy was that althoughdiarrheal and gastroenteritis diseases, resulting from poor sanitation and hygiene, had been found to cause as many deaths as HIV-AIDS and related diseases, more emphasis was still given to the later, with environmental sanitation and hygiene-related diseases often being ignored (GOK/MOH, 2007). For instance, Ministry of health data in 1999 indicated that 2,500 Kenyans died from diarrheal and gastroenteritis diseases as compared to a reported mortality of 2,787 from HIV-AIDS.

Kenya Environmental Sanitation and Hygiene Policy- KESHP 2016-2030

The National Environmental Sanitation and Hygiene Policy (NESHP) launched in 2007 has since December 2015 been reviewed to Kenya Environmental Sanitation and Hygiene Policy- KESHP 2016-2030, with the objectives of the policy review being twofold, firstly to meet the constitutional provisions as per the Constitution of Kenya 2010, under the environmental and sanitation rights guaranteed in Articles 42 and 43 (b) where “the state is obligated to make both legislative and policy measures including setting standards to achieve the progressive realization of the rights to ensure their widest possible enjoyment”; and secondly “to fulfil the provisions of the Fourth

Schedule Part II Articles 2(c) (d) (f) (g) and 11(a) (b) of the Constitution of Kenya", which provided for devolution of sanitation functions and related services to the 47 County Governments (MOH/GOK, 2016). The review was also made to align the policy to Kenya's Vision 2030, (GOK/MOH, 2016).

The policy scores high in terms of addressing the coordination and institutional framework challenges, firstlyby defining the roles and responsibilities of many actors (institutions and stakeholders) who include both public and private institutions and departments, allied non-state sector actors such as private sector, not-for-profit organizations such as NGOs, faith-based organizations and societies, the media, development partners, communities and individual households. Further, the policy, in recognizing the role of stakeholders at both the national and devolved units, it made key provisions to enable stakeholder's engagement in addressing the environmental sanitation and hygiene needs in the country. The Ministry of Health, together with other relevant ministries at national level retains the mandate of policies development and legislation, coordination and oversight, resource mobilization, monitoring and follow-up, public works, public investment, statistics and data collection, capacity building and technical assistance to Counties. The Counties, which are the developed units are responsible for the direct provision of sanitation related services such as solid waste management, drainage management, water and sanitation services as well as issuing sanitation related licenses (GOK/MOH, 2016).

The policy also realizes the need for institutional strengthening as a means of achieving sustainable sanitation services, and put in place mechanisms to achieve this, such as

enhancing the capacity of the Environmental Health and Sanitation Department to effectively play its role, establishing a National Environmental Sanitation Coordinating and Regulatory Authority (NESCRA), as thenational institution responsible for leadingthe national sanitation department, putting in place a multi-sector and multi-partner accountability mechanisms for delivery of sanitation and hygiene sustainable development results, "review of the existing structure, strengthening and establishing a well-functioning stakeholder co-ordination mechanisms andto build and sustain a political and technical support at both national and county levels among others" (MOH/GOK, 2016).

Another important aspect of a sanitation and hygiene policy according to (Elledge M, 2003) is to clearly define the target population focusing on three key groups, namely the urban poor (those living in slums and peri-urban areas), populations in small towns and the rural population. The Kenya Environmental Sanitation and Hygiene Policy- KESHP 2016-2030 has a clear policy direction in regards to scaling up both rural and urban sanitation as a means of attaining universal access to sanitation and completely eliminate open defecation by 2030. On sanitation access for the rural population, the policy has definite strategies aimed at promoting access to improved sanitation through participatory community health strategies involving households and community groups, such as integrated sanitation and hygiene promotion, adoption of total sanitation models, national, county government, and community's collaborations to support and develop safe sanitary interventions, motivations, technical support and minimal subsidies to communities, promotion of improved sanitation technologies, reuse of sanitation by-

products such as re-use of wastewater for agricultural purpose, biogas energy and county government enforcement of sanitation standards (MOH/GOK, 2016).

On urban and peri-urban sanitation, the policy aims at the effective disposal of increasing quantities of liquid and solid waste generated owing to the rapid urbanization, which shall be achieved through adoption of appropriate and cost effective technologies for collection, storage, removal, treatment and safe disposal or re-use of faecal sludge and waste water from both residential and commercial areas, promotion of household ownership and access to safe sanitary facility with suitable and affordable water conveyance system and from which faecal sludge can be safely collected and treated, promotion and establishment of public-private partnerships and private sector investment for the installation, operation and management of public facilities in small and medium towns (GOK/MOH, 2016).

The Kenya Environmental Sanitation and Hygiene Policy- KESHP 2016-2030 is to be implemented on five years rolling medium-term National and County Environmental Sanitation and Hygiene Strategic and Investment Plans, funded through the annual ESH work plans and budgets developed within the national and county budget framework. This clear roadmap of implementation is nevertheless dependent on budgetary allocation and priories by both the national government and the respective county governments. The policy has identified key financing mechanisms including public financing, with a country's commitment of over 0.5% of GDP to fund sanitation development. The county governments are also supposed to mobilize and allocate sufficient financial resources for the provision of all sanitation-related devolved services. The policy also highlights other

financing mechanisms such as the sanitation trust fund, development partners, private sector financings such as financial institutions, SMEs, developers and landlords, encouraged to invest in the development of affordable and appropriate technology options, facilities and infrastructure, and to actively participate in providing sanitation and hygiene services (GOK/MOH, 2016).

The Kenya Environmental Sanitation and Hygiene Policy- KESHP 2016-2030 is comprehensively developed as an effective tool to accelerate sanitation access and ensure universal access to improved sanitation for all by 2030. Nevertheless, the achievement of this goal, especially for urban areas requires improved financing at both national and the county level to support sanitation infrastructures such as the sewer network and public sanitation coverage. The other important aspect is the national/ county government collaborations with other sanitation actors such as developers, landlords to ensure compliance with urban sanitation master plans and standards.

2.3 Sanitation linkages to Health

Lack of adequate access to improved sanitation (together with safe water and hygiene) – WASHis known to cause a large number of diseases, classified intobroad four categories: **waterborne** (due to ingestion of contaminated water, fluids water, such as diarrhea); **water-washed** (due to poor hygiene practices, e.g. Trachoma); **Water-based** (transmission through aquatic invertebrate, e.g. such as schistosomiasis) and **water-related** insect vector routes (caused by insect vector in water, e.g. water, such as for malaria or dengue fever,(OECD, 2011). Provision of environmental sanitation coupled with water and proper knowledge, attitude and practices on WASH acts as barriers to

transmission of both waterborne and water-washed diseases,(Batteson et al, 1998). Figure 2 below shows oral-fecal transmission route (also called the F-Diagram) together with relevant interventions (barriers) which can be used to in each route.

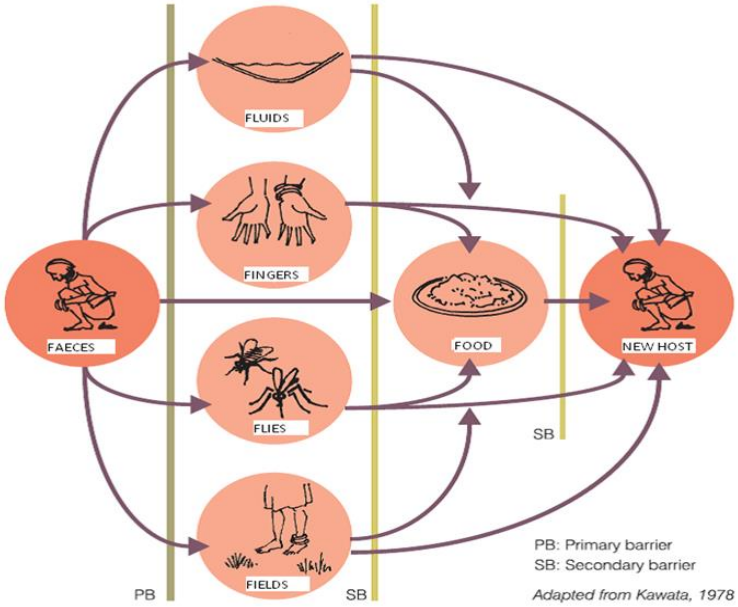


Figure 1: Transmission of diseases from faeces

Adapted from Kawata 1978, in Batteson et al, (1998)

Sanitation and hygiene (and water) act as both primary and secondary barriers in the fecal-oral transmission routes (Batteson et al, 1998)as below:

(i) **Primary Barriers (PB):** Improved sanitation, supported with personal hygiene, acts fundamentally 'as a primary barrier' by ensuring that faecal matter is disposed of safely, and does not spread in the environment. Sanitation also keeps away faeces from fluids and fields in addition to preventing the breeding of flies. **Faeces–Fingers** contamination,on the other hand,can be eradicated by the washing of hands with soap, alcohol or ash in five key times: after visiting latrines/ toilets; after handling

children's faeces; before eating; before handling food and after handling animals. (Kaiko, 2009)Also notes that discouraging children from sucking their fingers can also block the faecal-fingers contamination routes.

(ii) **Secondary Barriers (SB):** these are mainly water-related factors whichcanaid or prevents faecal–oral transmission in two ways: firstly through water-borne transmission, where contaminated water can cause infection to an exposed new host; and secondly, through water washed transmission, where insufficient water quantities lead to poor hygiene (hand washing), poor food handling and poor environmental sanitation, (Batteson et al, 1998). The two differ in that, while waterborne transmission can be controlled by ensuring water quality, water washed transmission can be controlled by ensuring adequate quantities of domestic water supply. Increasing the quantity of water also has an impact on some other water washed infections like Skin infections (e.g. Scabies, body lice, tropical ulcers) and several eye infections (e.g. Trachoma, conjunctivitis).

Sanitation access is also connected to other infections commonly referred to as Water-based diseases, which are caused by parasitic infections to human, where the parasite spends a part of its life cycle in an intermediate aquatic host, for instance,schistosomiasis (bilharzia) and guinea-worm. These infections can be similarly be eradicated by improved water supply in addition to environmental sanitation.

Sanitation worksin complementary with personal hygiene practices such as handwashing with soap. Handwashing with soap at the key times – i.e. after contact with faeces, before handling food and feeding an infant has been shown to significantly reduce the

incidence of both acute respiratory infections and diarrhea. A meta-analysis of 144 studies by (OECD, 2011) showed that the median reduction in diarrheal diseases due to improved water supply, water quality, sanitation and hygiene interventions were 27%, 17%, 22% and 33% respectively. Similar studies to assess the impact hygiene intervention on children by (OECD, 2011), involving a meta-analysis of 71 studies (which assessed 130 000 children in 35 countries) showed 31% reduction in child diarrhea morbidity due to hygiene intervention, while the combined effect of sanitation infrastructure and water quality led to 37% reduction in diarrheal morbidity. Fewtrell et al.(2005)in (OECD, 2011)study involving a meta-analysis of 60 studies on impacts of water quality and hygiene, gave a 40% reduction of diarrheal diseases while sanitation and water supply only gave a combined effect of 20% reduction in diarrheal infections.

The three studies suggest an average reduction of diarrheal diseases by 36% due to hygiene-related intervention. However, a systematic review of the effect of handwashing with soap by (Curtis V. A. et al, 2009)gave a higher value of 43% in reduction in diarrheal disease, but its effectiveness is only attributable to a sustained behaviour change (van der Knapp, 2006; Waddington, 2009, OECD (2011). These results show an important scenario, that improvement in water quantity is a critical factor for the adoption of hygienic practices, OECD (2011). A household requires sufficient amount of water to habitually practice hand hygiene. This idea is supported in Batteson et al(1998), who argue that increasing the quantity of water used by households is probably more important than increasing the quality in the reduction of non-epidemic diseases “as washing faecally-contaminated fingers and utensils, even with dirty water, is better than not washing at all”.

On a contrasting opinion, Waddington (2009), OECD (2011) argues that water quality is the critical determinant of health benefits rather than water quantity. This is supported by (Prüss-Üstün et al, 2008) in OECD (2011) research on point-of-use (POU) treatment solutions which showed a significant improvement on the impact of water supply interventions, with an estimated 45% reduction in diarrheal infections.

2.4 Theoretical framework

2.4.1 The economic theory of Infrastructure and Commons Management.

One of the theories that can be applied to the provision of sanitation services is Brett Frischmann's Economic theory of Infrastructure and Commons Management (Barbara N, 2012). The theory defines infrastructure as a physical resource system made by humans for public consumption. These infrastructures include transport system, communication, governance and public services system such as water and sewers (sanitation) Frischmann (2005). The theory refers these infrastructure resources as fundamental resources that add value when used as inputs into a wide range of productive processes.

This theory offers three opinionsfor value addition. Firstly, the resources should be used as inputs into a wide range of productive processes. Secondly, they generate positive outputs that benefit society, and thirdly, the infrastructure should be managed on open access basis. Therefore, the theory's proposition is that these resources, especially the public resources should be provided and managedby allowing public access to them on an obligatory and non-discriminatory basis. The theory, according to(Barbara N, 2012),

critiques any systematic right to exclude as inappropriate—a right that would be an integral part of a typical resource management scheme based on private property. The resources that are broadly shared and reusable, Frischmann theory argues that open access will be catalytic to the production of public and non-marketgoods. The theory is important and helpful in addressing issues of sanitation infrastructure/ resources and services providedto the urban poor, especially, in the urban informal settlements/ slums.

2.4.2 Integrated Behavioral Model In WASH (IBM-WASH)

Integrated behavioural model (theoretical framework) for water, sanitation and hygiene (IBM-WASH), developed by Dreibelbis and colleagues in 2013, (Dreibelbis et al, 2013) outlines key factors that influence behaviours in water, sanitation and hygiene interventions. Formulated after a systematic review of the models that existed and frameworks through a search of related articles available in PubMed, and iteration from pilot applications, the IBM-WASH framework theorizes that sustained WASH behaviour change is influenced by three dimensions/sets of factors – that can influence behaviour at multiple levels: **contextual factors**, **psychosocial factors**, and **technological factors**.

The **Contextual factors** are related to individual and/or environment settings, that promote (hinder) or influence adoption of improved technologies and practices such as media exposure, soil conditions, gendered division of labour among others. They also involve engaging the community or building the institutional capacity to influence the adoption and sustainability of improved technologies. **Psychosocial factors** are related to the psychological, social, or cultural factors that can influence both adoption and

sustained use of products and behaviours. They include aspects such as disgust or habit in adoption of hygiene and handwashing (Dreibelbis et al, 2013). Others include knowledge, self-efficacy, beliefs, outcome and expectations which have been found to influence the sustained adoption of water and sanitation technologies. **Technological factors** are aspects related to a specific technology that may influence its sustained adoption and use. These include ease-of-use, adaptability and durability, market access, manufacturing capacity, or level of ownership (shared or individual ownership) (Rimal R, et al, (2011), Verplanken B (2000), (Dreibelbis et al, 2013)

The frameworks also consider five aggregate levels generally equivalent to levels that exist in multi-level models. These includes: **theSocietal / Structural level** (focusing on the broad organizational, institutional, or cultural factors such as laws, policies, climate, geography, geology, and manufacturing and commercial distribution of products). The **Community Level** focusing on physical and social environment of an individual, as well as the formal and informal institutions that shape individual experiences). The **Interpersonal / Household Level** consider relationships between the individuals and the people associate closely such household members, close friends and neighbours). Key issues in this level include roles and responsibilities, household income, sharing access of facilities among others. The **Individual Level** considers sociodemographic factors – which include age, gender, individual cognitive factors, and attitudes toward the product, hardware, or behaviour. The **Habitual Level** refers to factors in-built within the individual, which ensures WASH-related behaviours are repeated and the multiple processes that can result in the specific behavioural outcomes.

IBM-WASH was developed to underscored the gap of absence of theoretical and empirical rationale for the implementation and evaluation of the interventions (Parker Fiebelkorn A et al, (2012) (Dreibelbis et al, 2013). Other models which existed often lacked focus on the contextual, psychosocial, and technology dimensions of WASH practices, or were biased to individual-level theories and outcomes. According to (Dreibelbis et al, 2013), IBM-WASH framework provides a simple, flexible tool for understanding WASH behaviours and habit formation that is informed by existing theoretical insights at multiple levels and dimensions. Its concept borrows entirely from other models such behaviour change theories and Social Cognitive theory. For instance, the three interacting dimensions i.e. contextual, psychosocial and technology reflects the concept of reciprocal determinism in Social Cognitive Theory, which describes reciprocal interactions between the individual, the behaviour, and the environment. The developers also argue that IBM-WASH framework meets the three criteria aspects for theories and development of theoretical frameworks by Crosby R, Noar SM, (2010), i.e derived from practice, transcend to individual level, "accessible" to practitioners

IBM-WASH takes the form of a matrix, with the three dimensions (columns) and five levels (rows) as shown in table 1 below:

Table 2-1: IBM-WASH model framework

Levels	**Contextual**	**Psychosocial**	**Technology**
Societal/ Structural	Policy and regulations, climate and geography	Leadership/advocacy, cultural identity	Manufacturing, financing, and distribution of the product; current and past

			national policies and promotion of products
Community	Access to markets, access to resources, built and physical environment	Shared values, collective efficacy, social integration, stigma	Location, access, availability, individual vs. collective ownership/access, and maintenance of the product
Interpersonal/ Household	Roles and responsibilities, household structure, division of labour	Injunctive norms, descriptive norms, aspirations, shame	Sharing of access to product, modelling/demonstration of use of product
Individual	Wealth, age, education, gender, livelihoods/employment	Self-efficacy, knowledge, disgust, perceived threat	Perceived cost, value, convenience, and other strengths and weaknesses of the product
Habitual	Favourable environment for habit formation, opportunity for repetition of behaviour.	Existing water and sanitation habits, outcome expectations	Ease/Effectiveness of routine use of productivity

Source: (Dreibelbis et al, 2013)

2.5 Conceptual Framework

The independent variable in this study isthe sanitation access while the dependent variable are the social-economic effects on household livelihood's such as : the health indicators (child mortality rate, life expectancy and morbidity) and livelihood indicators (income, expenditure, saving, investments). The intermediary variables are the

institutions and policies necessary for infrastructure development. The Conceptual Framework is as show in figure 2 (page 36)

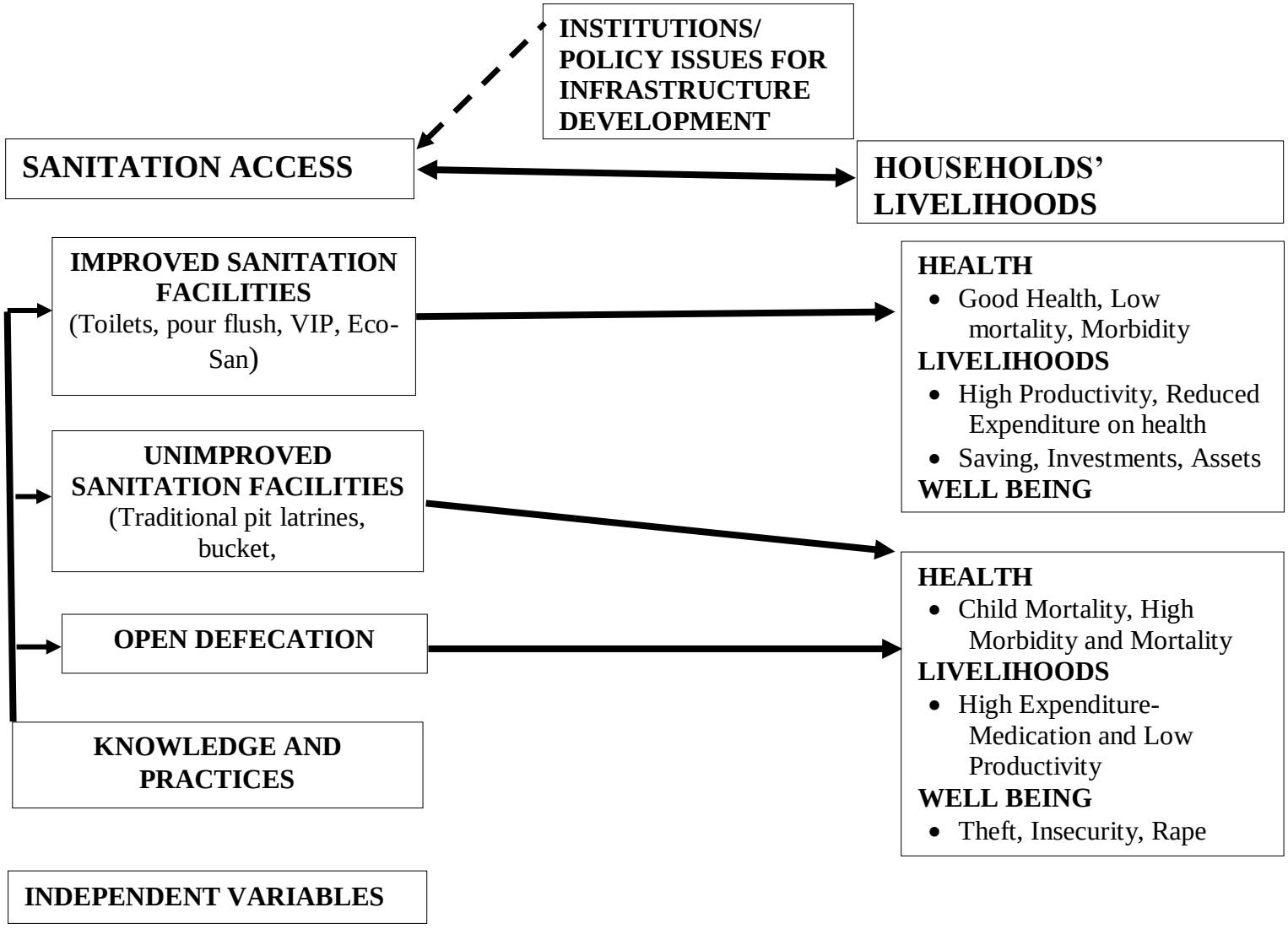


Figure 2: The Conceptual Framework

Source: own

2.6 Chapter summary

Chapter two presents the literature review related to the topic of study: effect of sanitation access on livelihood. Key literature reviewed included a thematic overview paper by Maria-Lücia Borba, Jo Smet and Christine Sijbesma (IRC, 2007) on Enhancing livelihoods through sanitation. A review of the role of sanitation policies on sanitation access is also presented here focusing on the new sanitation and hygiene policy of Kenya. Two theoretical frameworks have also been discussed: The Economic theory of infrastructure and common management and the Integrated Behavioural model in WASH (IBM-WASH).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methods and techniques that the research used in the collection of primary data. It describes the research design, study area, sampling size and sampling techniques as well as the data collection tools and methods used.

3.2 Research Design

The Descriptive research design was employed in this study. Mugenda & Mugenda (2003), defines descriptive design as a process of collecting data in order to test a hypothesis or to answer questions concerning the current status of the subjects in the study. It's a design which determines and reports the way things are. For instance, the study of the attitudes, behaviour, values and characteristics of households or community. Mugenda (2008)further states that descriptive design can be used to find disparities within a community and hence help in designing and hence employ certain inventions to reduce such disparities i.e. a study of the income levels, employment, education levels, access to food, clean water, health services or incidence of diseases in an area of study.

The study utilized mainly the quantitative techniques to collect data and to deduce the outcome of the phenomenon through observations, reconstructionsand analysis of the subject matter. The phenomenon in this research is sanitation access and its impact on households' livelihoods in Mathare slums, Nairobi County.

3.3 Target Population

The sampling unit in this study was a household, which is a unit consisting of one or more persons living togetherin the same dwelling and sharing sanitation facilities.

Thestudy targeted the urban population living in the informal settlements of Mathare slums, covering 4 wards of the large Mathare Constituency;Hospital ward, Mlango Kubwa, Mabatini and Ngei ward estimated about 50,585 households (estimated 2018),from KNBS/SID (2013). The targeted respondents for this study were the household heads or members of the households who could provide information on sanitation access and social-economic aspects of sanitation athousehold's level.

Table 3-1: Population data for 4 selected wards in Mathare constituency

Ward	**Population (2013 inequality survey)**	**Households**	**Average household size**	**Projected population -2018**	**Projected Households -2018**
Hospital Ward	19,832	6409	3.1	24,129	7,798
Mabatini Ward	28,222	9,675	2.9	34,336	11,771
Ngei Ward (Huruma A)	34,437	11,022	3.1	41,898	13,411
Mlango Kubwa	38,135	14,470	2.6	46,397	17,605
Total – 2013 (KNBS/SID, 2013)	**120,626**	**41,576**		**146,760**	**50,585**

Source: (KNBS/SID, 2013)

The study also involved collection of medical data from the four main medical facilities serving the four wards, namely: Huruma lions health centre (Ngei ward- public), Mathare police deport dispensary (Hospital ward - public), Upendo dispensary (Hospital ward- public) and SHOFCO clinic (Hospital ward-private and donor-supported). The data was used to investigate the main diseases in the area especially those related to sanitation, commonly referred to as water-borne diseases.

3.4 Sampling Procedure and Sample Size

Orodho (2004), defines sampling as the process of selecting a subset of cases or subjects in order to draw conclusions about an entire population. Sampling was therefore employed to reduce the amount of data to be collected by considering only data from a sub-group rather than all possible cases or elements.

3.4.1 Calculation of sample size

The sample size in this research was estimated using Miller and Brewer (2003)formula below:

Using $\boldsymbol{n} = \frac{N}{1+N(\alpha^2)}$ **Equation 1: Calculation of sample size**

Where:

α = is the level of significance or margin of error

N = is sample frame

n = is the sample size

Research Assumptions:

- α – margin of error assumed at 8% (0.08) at a confidence level 92% (owing to limited resources)
- **N – sample frame is 50,585 households**

$$n = \frac{(50{,}585)}{1+50{,}585(0.08)^2} = \mathbf{155}$$

3.4.2 Sampling techniques

The study employed several sampling techniques. Firstly, the researchused theStratified sampling method**,** whichinvolved considering each ward as a stratum, assumed to have

some distinct characteristics, different from the other. Each of the strata (ward) wassampled as an independent sub-population, out of the sample size was considered. The samplesize foreach ward was selectedbased on the proportion of population sizeand the number of households. The second process involved the construction of spatial network grids in each of ward as defined by roads and other public amenities. Each grid was assumed to share some common characteristics in terms of sanitation services, sewer connections or housing type. Simple random sampling was used to select samples within different grids until the sample for each ward was completed. Although samples for each ward/ strata was collected, sampling in some areas was somehow affected by insecurity with somesectionscompletely inaccessible due to direct aggression on the enumerators.

The proposed sample size for each ward is as summarized in the table below:

Table 3-2: Sample sizes in each of the four wards

Ward	**Households (2013 equality survey)**	**Projected Households -2018**	**Sample size**
Hospital Ward	6409	7,798	24
Mabatini Ward	9,675	11,771	36
Ngei Ward (Huruma A)	11,022	13,411	41
Mlango Kubwa	14,470	17,605	54
Total	**41,576**	**50,585**	**155**

Source: **(KNBS/SID, 2013)**

The medical facilities of health (clinics and dispensaries) were purposively selected based on the population they served and nature of the facilities. The public facilities

were more preferred due to higher coverage and lower cost compared to the private clinics.

Table 3-3: Sampled health facilities

Medical facility of health	**Location**	**Type**
Mathare Lion's health centre	Ngei	Public
Upendo health clinic	Hospital ward	public
Police depot	Hospital ward	Public
SOFCO	Hospital	private

3.5 Data Collection

Primary data was collected using Kobocollect, which is a digital mobile-based platform designed to capture data. A questionnaire was first designed covering all areas of interest, then uploaded into*KoBoToolbox* and validated through a trial data collection process. The toolkithas a mapping tool which can map and track when and where data sampling is carried out. The data collection was executed with the help of four assistants (enumerators) who were trained and allocated with mobile phones equipped with the data collection tool. The collected datawas posted on real time, with the posted data being visible in the researcher's account, showing the exact location of enumeration. This enabled timely data quality checks and feedback, which helped in timely correction of errors.

The questionnaires used were mainly structured, with both closed and open-ended questions intended to produce the required information from the respondents,to help answer the research questions. The questionnaires were carefully designed and pre-tested with a few members of the population for further improvements. This was done in order to enhance validity and accuracy of data to be collected. The variables gathered through the questionnaire consistedof: The respondent's bio-data: such as age of respondent (years), gender, educational status, marital status (single/married/ divorce or separated/ widow), number of family members; households socio-economic characteristics: family income, and occupation of the household head (professional, semi-professional, clerical, shop owner, farmer, skilled worker, semi-skilled worker, unskilled worker, unemployed); Sanitation access: access to toilet facilities, type of facilities, hand washing and waste disposal facilities; health concerns related to sanitation and direct structured observation on hygiene practices at key occasions (food/water handling at households, public toilets, cleaning a child after defecation, hand washing, toilet use among others).

Observations was also used as a technique for collectingprimary data. This provided information on the availability of sanitation and hygiene facilities as well as the general condition of the environment. Practices such as handwashing with soap, dumping of wastes in waste pits or in the compound were observed.Secondary data was collected through review and analysis of published materials and information from other sources such as annual reports, books/ e-books, journals as well as internet materials. Numerical data especially that from the National Bureau of Statistics was used to compare with the

research findings. Mugenda & Mugenda (2003),suggests that numerical records can also be used as a subcategory of documents which include figures, reports and budgets.

3.5.1 Pilot testing of the instruments

Pilot testing refers to field testing the survey instruments in order to provide a rationale for the design. The main purpose of the pre-test in this research was to familiarize with the respondents and test the suitability of the research tool (questionnaire). The feedback from the pre-test was used to modify the questionnaire to avoid ambiguity in the answers received. This pilot test was conducted by the researcher together with the data assistants during the training in the neighbouring ward (Huruma ward).

3.6 Reliability and Validity of the research

3.6.1 *Reliability*

Reliability is the level of internal consistency or stability of the research tool over time. It refers to the extent to which the instruments yields the same results on repeated trials. Reliability was ensuredthrough careful design of research tools, training of the enumerators and administering of the questionnaires in a way understandable to the respondents. Pre-testing of the tools was also done to check theconsistencybefore the actual data collection.

3.6.1 Validity

Mugenda & Mugenda (1999) defines validity as the extent to which the research instrument captures what it is expected to measure,in order to answer the research questions. It refers to the degree towhich the results obtained from the data analysis

represent the phenomenon under study.Validity in this research was also achieved through the pre-testing of the survey toolon a sample of the target population before the actual data collection process.

3.7 Data Analysis Techniques

(Mugenda & Mugenda, 2012)Defines“data analysis as the process of cleaning and summarizing data so that it becomes information that can easily be interpreted and conclusions made to support decision making”.The collected data was posted directly to Kobotoolbox account, then cleaned and exported to Microsoft Excel spreadsheet and Statistical Package for Social Scientists (SPSS) for analysis. The analyzed data was represented using frequency distribution tables, charts and graphs.

3.8 Ethical Considerations

For this research work, a letter of recommendation was provided by St. Paul’s University which helped to obtain a research permit from the National Commission for Science, Technology & Innovation (NACOSTI). Further approvals were obtained from the County Education office, Sub-County education office, the County Commissioner’s office and the sub-county commissioner’s office. Medical health records data were obtained with permission from the Nairobi County medical services and Ministry of Public Health and Sanitation. Verbal informed consent wasalso obtained for all interviews.Confidentially was also assured with a declaration that the researcher had no conflict of interest and that the information was purely for academic purpose and personal details were held in total confidence.

3.9 Chapter Summary

This chapter discusses the methodology and research design used for this research. The research was carried out in Mathare valley slums, Nairobi County focusing on four wards, namely Mlango Kubwa, Mabatini, Ngei and Hospital wards. The sample size was one hundred and fifty-fivehousehold's respondents who were selected through a stratified sampling procedure followed by simple random sampling. A mobile-based data collection capture method was done using the Kobocollect toolkit, which is an open source data collection platform was used, where the data collection tool was uploaded.The data collection technique used was mainly through face to face interviews. Other techniques used included direct observations, Key informants (KIs) and review of secondary medical data. In the following chapter, the collected data was analyzed, represented and interpreted to answer the questions raised in this research.

CHAPTER FOUR: DATA ANALYSISANDPRESENTATION

4.0 Introduction

This chapter presents adescriptive statistic of the study carried out in the four wards of Mathare constituency, Nairobi County, Kenya, namely Hospital, Mabatini, Mlango Kubwa and Ngei wards to assess sanitation access and its effects on household's livelihoods. Summaries of analysed dataare presented based on the objectives of the study. The results have been organized under the following categories; demographic data, sanitation access, knowledge and practices on water and hygiene,economic effects of sanitation access and health effects of sanitation access.

4.1 Studies response rate

The study targeted a sample size of 155 households out of which 160household's respondents participated in the survey, representing 103% response rate.However, the five additional respondents were cleaned off due to invalidity of some entries. The survey was done through mobile data capture where primary data was directly recorded and send to researchers account for analysis.

Table 4-1 below shows the respondent's response rate in the study area as highlighted above.

Table 4-1: Households' respondents and response rate

Ward's name	Sampled respondents	Analysed sample size (households)
Hospital Ward	24	24
Mabatini Ward	36	36
Ngei Ward (Huruma A)	43	41
Mlango Kubwa	57	54
Total	**160**	**155**

Source: Own field data presentation

The mapin figure 4 shows the location and distribution of household'srespondents in each ward as extracted from Kobocollect toolbox map. The points show the GPS coordinates for the sampled households in each ward as shown in table 4-1. (the location accuracy was between 5-10m).

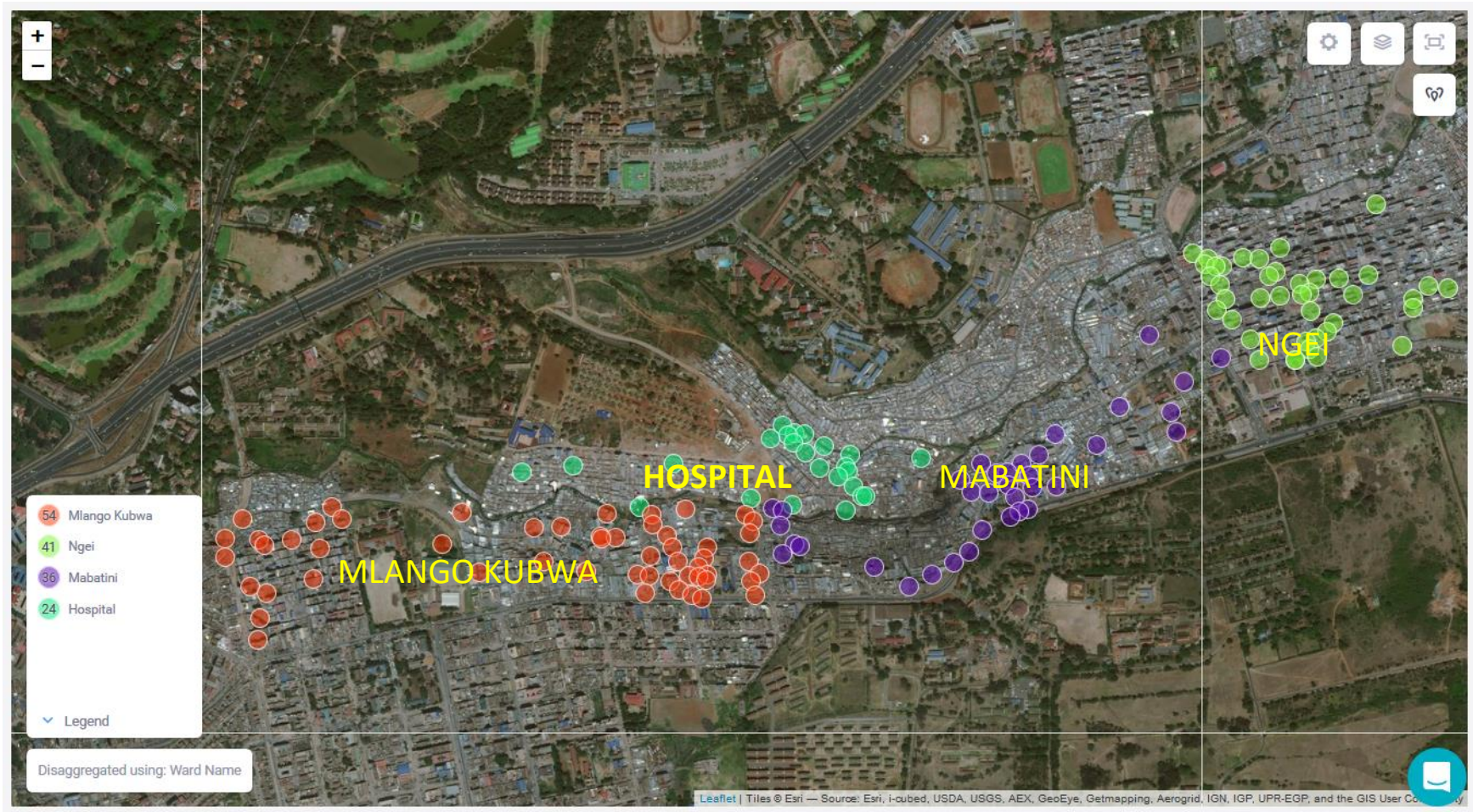


Figure 3: Enumeration Map- Kobocollect Toolbox extract

Source: KoBoToolbox collect

4.2 Respondents bio-data

This section summarizes the demographic characteristics of the sampled household's respondentswho participated in the study. These data include the sex, age, marital status, and education level as highlighted in the proceeding sections.

4.2.1 Gender of the respondents

In this research, both male and female respondents were interviewed with 98 respondents (63%) being female and 57 respondents (37%) being male. Both men and women have sanitation needs and are affected by inadequate access to sanitation at household level, hence the views of each gender was considered significant. Nevertheless, women are more affected since they are often the caregivers.

Table 4-2: Summary of respondent's characteristics

N=155 Gender of household's respondents	**Values**	**Frequency of respondents**	**Valid frequency**	**Percent (%)**
	Males	57	57	37%
	Females	98	98	63%
	Total	**155**	**155**	**100%**

Source: Own field data presentation

4.2.2 Age characteristics of the respondents

The respondent's age ranged between 17 years and 68 years. The mean, medianand the standard deviation of the respondent's age were 32.6 years, 30 years and 10.5 respectively as shown in table 4-3.

Table 4-3: Age characteristicsof the respondents

Statistical measure	**Values**	
Mean	32.6	
Std. Error of Mean	0.843	
Median	30.0	
Mode	23.0	
Std. Deviation	10.5	
Variance	110	
Range	51	
Minimum	17	
Maximum	68	
Percentiles	25	25
	50	30
	75	37

Source: Own field data presentation

Table 4-4 shows the age brackets of the respondents. Of the 155 respondents interviewed, 80% of the respondents were within the productive age of 18-40 years. On the other hand, 81% of the household's respondents can be classified as the youth as they are 40 years or below. The least respondents were of ages younger than 18 years (1%), done purposely to avoid bias due to use of uninformed respondents while those aged more 60 years, represented only 3% of the respondents.

Table 4-4: Age brackets of the household's respondents

	Values	**No. of respondents**	**Valid frequency**	**Percent (%)**
Distribution of Age of HH respondents	12-17 years	1	1	1%
	18-24 years	37	37	24%
	25-40 years	87	87	56%
	41-59 years	26	26	17
	Over 60 years	4	4	2%
	Total	**155**	**155**	**100%**

Source: Own field data presentation

4.2.3 Marital status of the respondents

Table 4-5 below summarizes the marital status of the sampled household's respondents. 64% of the respondents were married while 29% of the respondents were single. The remaining 7% were either divorced/ separated (4%) or widowed (3%).

Table 4-5: Marital status of the respondents.

	Values	Frequency	Valid frequency	Percent (%)
Marital Status of the respondents N=155	Married	99	99	**64%**
	Single	45	45	**29%**
	Separated/ Divorced	6	6	**4%**
	Widow/er	5	5	**3%**
	Total	**155**	**155**	**100%**

Source: Own field data presentation

4.2.4 Level of education of the respondents

Table 4-6 below summarizes the education level of the respondents. 41% of the respondents had only completed primary level (class 8) of education while another 40% had gone up to O level (form 4) of education, with only 7% not being able to read and write. This implies that the majority of the respondents were able to understand and respond to most of the research questions asked by interviewers.

Table 4-6: Level of education of respondents

Education level of respondents	No. of respondents	Percentage
Can't read/ write	11	7%
Class 8	63	41%
O level/ Form 4	62	40%
College (certificate/ diploma)	15	10%
Graduate (degree and above)	4	2%
Total	**155**	**100%**

Source: Own field data presentation

4.3 Respondent's household's socio-economic data

4.3.1 Gender/ sex of the household's head

Table 4-7 below summarizes the gender of the head of sampled households. 104 respondents, representing (67%) of the respondents indicated that their households were male-headed, while 51 respondents (33%)came from female-headed households.There were no child-headed households sampled by the respondents.

Table 4-7: Gender of respondent's households head

	Values	**Frequency**	**Valid frequency**	**Percent (%)**
Household's head N=155	Malehead of Household	104	104	**67%**
	Female head of Household	51	51	**33%**
	Total	**155**	**155**	**100%**

Source: Own field data presentation

4.3.2 Respondent's households'size and composition

Table 4-8 and 4-9 summarizes the respondent's household's size and characteristics. The household's sizes ranged between 1 and 13 members, with a mean household size of 3.9 persons, median of 4 and a standard deviation of 2.05. The lower percentile (25%) was 3 while the upper percentile (75%) was 5.

Cumulatively, 66% of the sampled households indicated to have household sizes of between 1-4, which compares to **KNBS/SID (2013),** whichdeduced that Nairobi County hadlow fertility rates among women with 62% ofhousehold'ssize having 0-3 members. On the other hand, household sizes beyond 6 members were very rare, with only 5% of the households having 7members and more.

Table 4-8: Respondents household's size

Household size	**Number of households**	**Percent**	**Valid Percent**	**Cumulative Percent**	**Total population**
1	20	12.9	12.9	12.9 %	20
2	17	11	11	23.9%	34
3	33	21.3	21.3	45.2%	99
4	32	20.6	20.6	65.8%	128
5	23	14.8	14.8	80.6%	115
6	16	10.3	10.3	91%	96
7	7	4.5	4.5	95.5%	49
8	3	1.9	1.9	97.4%	24
9	2	1.3	1.3	98.7%	18
10	1	0.6	0.6	99.4%	10
13	1	0.6	0.6	100%	13
Total	**155**	**100**	**100**		**605**

Source: Own field data presentation

Table 4-9: Respondents household's statistics

Statistical parameter		Value
Mean		3.9
Median		4.0
Mode		3.0
Std. Deviation		2.05
Variance		4.2
Range		12
Minimum		1
Maximum		13
Percentiles	25	3.0
	50	4.0
	75	5.0

Source: Own field data presentation

Table 4-10 shows how the respondent's household's sizes differed from one ward to another. Ngei ward had the lowest mean household size of 3.51 followed by Mlango Kubwa (3.54), while the highest was Mabatini ward (4.75), followed Hospital ward with a mean average household size of 4.17. Similarly, Mabatini wards had the largest household sizes, with members ranging between 1-13, while Ngei ward had the smallest household's sizes ranging between 1-6 members.

Table 4-10: Respondent's household's sizes in the 4 wards

Ward	Mean	Median	Mode	Std. Deviation	Variance	Range	Min	Max
Hospital N=24	4.17	4	3	1.78561	3.188	7	1	8
Mabatini (N=36)	4.75	4	3	2.60082	6.764	12	1	13
Mlango Kubwa (N=54)	3.54	3.5	4	1.79846	3.234	8	1	9
Ngei (N=41)	3.51	3	3	1.74817	3.056	6	1	7

Source: Own field data presentation

Table 4-11 shows the proportion of households with children below the age of 5 years. 48% of the respondents indicated that their households didn't have children aged below 5 years while 50% of the respondent's households indicated that they had 1 or 2 children aged below 5 years. None of the households had more than 3 children aged less than 5 years. Children less than 5 years are more affected by diarrhea and other sanitation-related diseases hence households with children below the age of 5 years are more affected by lack of improved sanitation at the household level.

Table 4-11: Households with children aged less than 5 years

Household type (N=155)	**Number of households**	**Percentage**
Households with no child aged below 5 years	75	48%
Households with one child aged below 5 years	51	33%
Households with two children aged below 5 years	26	17%
Households with three or more children aged below 5 years	3	2%
Total	**155**	**100%**

Source: Own field data presentation

Table 4-12 summarizes the respondent's household'scomposition in the four wards. 46% (i.e 19% + 27%) of the respondents indicated they had household's members ranging from 0-17 years indicating the level of dependency in the area. On the other hand, 53% of the respondents indicated to have household'smembers of ages 18-59 years, representing the populations involved in income generation activities.

Table 4-12: Respondent's household composition

	No. household members in the category					
Household members' age	**Hospital**	**Mabatini**	**Mlango Kubwa**	**Ngei**	**Total**	**Percent**
0-5 yrs	18	22	48	24	112	19%
6-17 years	24	58	43	34	159	27%
18-59 years	55	85	102	82	324	53%
over 60 years	1	5	4	0	10	2%
Total	**98**	**170**	**197**	**140**	**605**	**100%**

Source: Own field data presentation

The bar graph below in figure 5 shows the distribution of different age brackets in the four wards. Mlango Kubwa ward had more members aged 0-5 years and 18-59 yeas compared to the other wards while Mabatini ward had more household members aged 6-17 years.

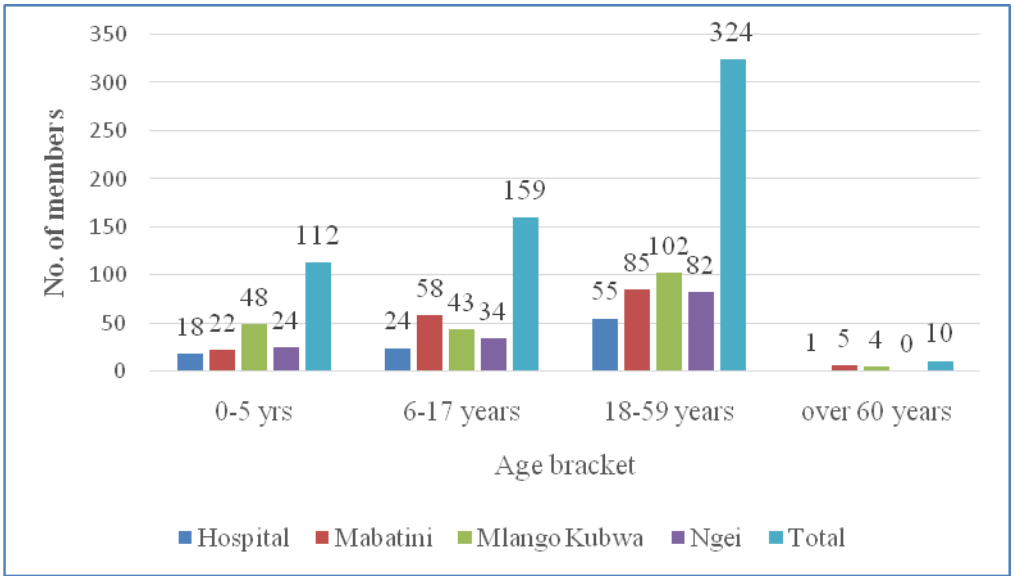


Figure 4: Composition of household's members per ward.

Source: Own field data presentation

4.3.3 Occupation of the household's head

Table 4-13 shows the occupations of the respondent's household heads. 64 respondents representing 41% indicated that their household's heads were unskilled/ labourers, while another 31 (20%) said they were business persons (Shopkeeper/clothes vendors, small to middle sized business). In addition, 13%(20) of the respondent's household's heads were trade persons such as masonry, carpenters, masons and painters, while those whosehousehold's heads were unemployed represented 10% of the households. The unemployment rate is comparable to Nairobi county total unemployed at 11.1% according to(KNBS/SID, 2013). Overall, 61% were either doing unskilled work/ labour or small to medium scale businesses.

Table 4-13: Occupation of the respondent's household head

Occupation type (N=155)	No. of respondent's household heads	Percentage
Unemployed	15	10%
Unskilled/ labourer	64	41%
Business (Shopkeeper/clothes vendors, small to middle sized business)	31	20%
Tradesman (Mason, carpenter, welder, painter)	20	13%
Skilled worker	15	10%
Middle level professional (Teacher/ nurse)	7	5%
Clerical (secretary, clerk, teller)	3	2%
High level professionals (Engineers, doctors, lecturer etc)	0	0%

Total respondents	**155**	**100%**

Source: Own field data presentation

4.3.4 Level of income of the household head

Table 4-14 shows the income brackets of the household heads in the study area.Majority of the household's heads earnedin the range of Ksh.7,501-10,000 (25%). Overall, 61% (94 respondents) indicated that their household heads earned Ksh. 10,000 and below. The level of income at household level determines the ability to pay for social amenities such as sanitation access, water or health care.

Table 4-14:Level of income of the respondent's household head

	Number of respondents	**Percent**	**Valid Percent**	**Cumulative Percent**
Less than 3000	2	1.3	1%	1
3001-5000	22	14.2	14%	15
5001-7500	31	20	20%	35
7501-10000	39	25.1	25%	60
10001-1500	27	17.5	18%	78
15001-20000	17	11	11%	89
20001-25000	5	3.2	3%	92
25001-35000	9	5.8	6%	98
over 35,000	3	1.9	2%	100
	155	**100**	**100**	

Source: Own field data presentation

4.3.5 Respondents household's expenditure on sanitation in proportion to total expenditure

Table 4-15 shows the respondents household's expenditure on latrine use. (Only 80 respondents gave response to this question). The average monthly expenditure on latrine use was Ksh. 173 with a standard deviation of 199.8. The mode and median expenditure on sanitation was Ksh. 100 (i.e. monthly subscription fee for a public toilet).

Table 4-15: Respondent's household status of residence

What is the household's monthly expenditure on latrine access					
Ksh. (x)	**No of respondents(f)**	**Percent**	**Valid Percent**	**Total (x*.f)**	**(x -x*)^2**
50	6	4	8	300	15,160
100	48	31	60	4,800	5,347
150	13	8	16	1,950	535
200	4	3	5	800	722
300	2	1	3	600	16,097
400	1	1	1	400	51,472
500	1	1	1	500	106,847
600	3	2	4	1,800	182,222
1,200	1	1	1	1,200	1,054,472
1,500	1	1	1	1,500	1,760,597
Total	**80**	**52**	**100**	**13,850**	**3,193,473**
Missing	75	48			
Total	**155**	**100**	**Mean (x*)**	**173**	
			SD	**199.8**	
			Mode	**100**	

Median	**100**

Source: Own field data analysis

The total household's expenditure is as summarized in the table 4-16 below (full data shown in appendix VI, table 11). The mean total expenditure was found to be Ksh. 12,398 with a standard deviation of 7,533. The mode and median total expenditures were Ksh. 9,250 and Ksh. 10,530 respectively.

Table 4-16: Respondent's total household's expenditure

Households total expenditure (N=155)	**Statistical value**
Mean total expenditure (Ksh.)	12,398
Standard deviation	7,533
Mode (Ksh.)	9,250
Median (Ksh.)	10,530

Source: Own field data analysis

From table 4-15 and table 4-16, the ratio of mean sanitation expenditure to the total expenditure is **173: 12,398** which is equivalent to 1.4%.

4.3.6 Household's current status of residence

Table 4-17 shows the residence status of the respondent's households in the study area. Of the sampled respondents, 149 respondents indicated that their households where were renters (96%), while only 2% lived in "rent-free dwellings".Another one percent were squatters. The status of residence determines the responsibility of sanitation

development since house owners are mainly responsible for development of sanitation facilities.

Table 4-17: Respondent's household status of residence

Parameter	Residence status of households	No. of respondents	Percentage
Residence type (N=155)	Rented	149	96%
	Privately owned	3	2%
	Squatter	3	1%
	Others	1	1%
	Total	**155**	**100%**

Source: Own field data presentation

On the type of settlement (in respect to planning, permanent or temporary shelters), 43% of the respondents lived in iron sheets walled/ roofed houses with another 21% in mud walled iron roofing informal settlement. 24% lived in planned multi-dwelling building while another 12% lived in stone walled single swelling units as summarized in table 4-18 below.

Table 4-18: Household'ssettlement/ shelter type

	Description	Frequency	Percentage
Settlement/ Shelter type/ wall type or	Iron sheets/ informal settlement	67	43%
	Mud-walled/ iron sheet roofing/ informal settlement	32	21%

roof type (N=155)	Apartments/ flats/ multi-dwelling units	37	24%
	Stonewalled single unit with own compound	19	12%
	Total	**155**	100%

Source: Own field data presentation

4.4 Households access to sanitation

4.4.1 Sanitation access level in the study area

Table 4-19 summarizes household's access to sanitation in the study area. Of the 155 sampled households, 77 respondents, representing about 50% of the respondents indicated that they had an access to a sanitation facility (toilet or a latrine) within their dwelling, while the other 78 respondents (50%) didn't have access to a sanitation facility within their dwelling.

Table 4-19: Access to sanitation facility

Parameter	**Answer to Response**	**Number of respondents**	**Percentage**
Sanitation facility access (N=155)	No	78	50%
	Yes	77	50%
	Total	**155**	**100%**

Source: Own field data presentation

The study found out those who didn't have access to a sanitation facility at the household dwelling either used a public toilet, shared neighbour's toilet or used plastic

bag/ bucket. Public toilets were the most commonly used sanitation facilities at 45%, while 6 percent either shared from neighbours or used plastic bags as shown in table 4-20.

Table 4-20: Access to different sanitation options

Parameter	Description	Number of respondents	Percentage
Access to sanitation options (N=155)	Household/ shared toilet/ latrine	77	**50%**
	Public toilet	71	**45%**
	Neighbour toilet	6	**4%**
	Plastic bag	1	**1%**
	Total	**155**	**100%**

Source: Own field data presentation

On the reason for not having a sanitation facility, 85% of the respondents without a sanitation facility reported to have rented a house without a toilet while 15% mentionedother reasons such as lack of space for construction orsanitation being not a priority, as shown in table 4-21.

Table 4-21: Reason for not having a toilet/ sanitation facility

Reason for not having a toilet	No. of responses	Percentage

(N=78)		
Rented house with no sanitation facility	66	85%
Others (no space for construction, not a priority and others)	12	15%
Total	**78**	**100%**

Source: Own field data presentation

4.4.2 Sanitation access by type and disposal type

Table 4-22 shows the sanitation access by sanitation type and waste disposal method. Pour-flush toilets were reported as the most common type of sanitation facilities found in the four wards and used by 37% of the respondents followed by water closet/ flush toilets at 7%. Overall, 44% of respondents can be categorized to have an access to improved sanitation facilities.

On sewerage disposal, over 40% of the respondents indicated to be connected to citysewer network while 4% were discharging into drainage channels or creeks. About 6% of the respondents were using on-site sanitation disposal systems such as septic tanks and pit latrines.

Table 4-22: Sanitation type and waste disposal type

Category	Description	Frequency	Percentage
Sanitation facility type (N=155)	No access	78	50%
	Pour Flush toilet	57	37%
	Water Closet/ flush Toilet	11	7%
	Pit latrine with slab/stone walls	6	4%
	Others	2	1%
	Traditional latrine/ timber slab and	1	1%

	iron sheet walls		
	Total	**155**	**100%**
Waste disposal type (N=155)	No access	78	50%
	Sewer system	61	40%
	Drainage/ river	6	4%
	Septic tank	5	3%
	Pit latrine	5	3%
	Total	**155**	**100%**

Source: Own field data presentation

4.4.3 Sanitation access by the number of households sharing

Table 4-23 shows the households sharing sanitation facilities. The study found out that 83% of the respondents households having access to a sanitation facilitiesat household dwelling shared their sanitation facilities with other households. The other 17% of the respondent households were not sharing their facilities. On the number of families sharing sanitation facilities, 60 (78%) of the respondents reported that their facilities were shared by 5 and more households (about 30 persons) while only 4 (5%) of the facilities were shared by 2-4 families.

Table 4-23: Households sharing sanitation facilities

Parameter	**Description**	**Number of respondents**	**Percentage**
If the facilities are shared (N=77)	Yes	64	83%
	No	13	17%
	Total responses	**77**	**100%**

No. of families sharing the facility (N=77)	More than 7 families	50	**65%**
	5-7 families	10	**13%**
	2-4 families	4	**5%**
	Not sharing	13	**17%**
	Total valid responses	**77**	**100%**

Source: Own field data presentation

4.4.4 Sanitation access by the distance from the household's dwelling

Table 4-24 shows the distance of the sanitation facility from the household dwelling. 58 respondents representing 10% of the respondents had their sanitation facilities within their dwelling while another 37% had their sanitation facilities within 30m from their dwelling.Only 3% of the respondents had their sanitation facilities located more than 50m from the household dwellings.

Table 4-24: Distance of the sanitation facility from the household's dwelling

Distance from sanitation facility (N=155)	**Number of respondents**	**Percentage**
No access	78	50%
Within 30 m	58	37%
Inside the house	15	10%
More than 50 m	3	2%
100 m from the household	1	1%
Total	**155**	**100%**

Source: Own field data presentation

4.4.5 Sanitation access level by ward or area

Table 4-25 shows the comparison between the shelter/settlement type and access to sanitation facility. Ngei ward was found to have the highest access to sanitation facilities at 93% followed by Mlango Kubwa (46%) and Mabatini (33%) with hospital ward having the lowest sanitation access at only 8%. Sanitation access was mainly influenced by the shelter/ settlement type, with areas having more permanent/ planned housing registering a better sanitation access; for instance, Ngei ward with 76% of dwellings as apartments/ flats/ multi-dwelling units had the highest sanitation access compared to hospital ward whose highest proportion (88%) of household's dwellings wereIron sheets/ informal settlement, had the lowest sanitation access as summarized in the table below:

Table 4-25: Sanitation access and shelter type by ward/ area

Location (Ward Name)	Sanitation access	Shelter type(N=155)		
		Stonewalled single unit with own compound	Iron sheets/ informal settlement	Apartments/ flats/ multi-dwelling units
Ngei	93%	14%	10%	76%
Mlango Kubwa	46%	6%	87%	7%
Mabatini	33%	19%	75%	6%

Hospital	8%	12%	88%	0%

Source: Own field data presentation

4.4.6 Ownership/ financing of sanitation facilities

Table 4-26 shows how sanitation how household sanitation facilities are financed. The study found out that household sanitation facilities are developed and financed by landlords, as reported by over 98% of the respondentshaving access to household sanitation, while only 1% were self-financed. External support from financiers such as NGO was only 1%. This points at the limited institutional support in financing household's sanitation infrastructure. Nevertheless, most of the public sanitation facilities were found to have been financed by donors, county government or the central government through the ministry of devolution.

Table 4-26: Financiers/ ownership of household'ssanitation facilities

Facility financed by (N=77)	**Number of respondents**	**Percentage**
Landlord	75	98%
Self	1	1%
NGO	1	1%
Total	**77**	**100%**

Source: Own field data presentation

4.4.7 Level of satisfaction with sanitation access

Table 4-27 and 4-28 summarizes the household's level of satisfaction with their sanitation facilities. All the respondents mentioned that they were somehow dissatisfied with their current sanitation facilities. 55 of the respondents (35%) cited the use of the facility by many people as the main reason for being dissatisfied with the sanitation facilities. This was mainly attributed to privacy, convenience and inability to keep the facility clean. The second reason was the distance of the facility from the household dwelling at 20% (32 respondents) followed by non-availability of water at the facility at 20% (31 respondents) and facility not secure 12% (7 respondents). The least cited reason for dissatisfaction with the sanitation facility was the design/ technology mentioned by 2 respondents (1%).

Table 4-27: Level of satisfaction with the sanitation facility

Reasons for not being satisfied with the facility (N=155)	**No of respondents**	**Percent**	**Valid Percent**	**Cumulative Percent**
Facility used by many people	55	35%	35%	35%
Facility very far away	32	20%	20%	55%
Non-availability of water	31	20%	20%	75%
Facility not secure	12	7%	7%	82%
Facility not well constructed/ designed	2	1%	1%	83%
Combination of factors (as show in table 4-26)	26	17%	17%	100%

Total	**155**	**100**	**100**	

Source: Own field data presentation

26 of the respondents mentioned more than one reason why they were dissatisfied with the facilities. The highest mentioned combination was that of the facility being used by many people and facility not well constructed/ designed mentioned by 5 respondents followed by facility used by many people and facility very far away (4 respondents), facility used by many people and facility not secure (3 respondents) and facility used by many people, facility not well constructed/ designed and non-availability of water (2). Other combinations were only mentioned once as show in table 4-26.

Table 4-28: Level of satisfaction with the sanitation facility (combination of factors)

Reasons for not being satisfied with the facility (N=155)	No of respondents
Facility used by many people Facility not well constructed/ designed	5
Facility used by many people, Facility very far away	4
Facility used by many people, Facility not secure	3
Facility used by many people, Facility not well constructed/ designed Non-availability of Water	2
Facility used by many people, Non-availability of Water, Facility very far away	1
Facility used by many people, Non-availability of Water	1
Facility used by many people, Non-availability of Water Facility very far away	1
Facility used by many people, Facility not secure, Facility very far away	1
Facility used by many people, Non-availability of Water	1
Non-availability of Water Facility very far away	1
Facility not secure, Facility very far away	1
Facility not well constructed/ designed Facility used by many people	1
Facility not well constructed/ designed Non-availability of Water	1
Total	**26**

Source: Own field data presentation

Insecurity when using the toilets/ latrines

Insecurity threatsduring the use of a sanitation facility, although ranked 4th for dissatisfaction with the facilities, had about 34% of the respondents reporting that they felt insecure when using the facility. The reasons for insecurity were: fear of darkness at the facility (37%); fear of muggers (23%); distance from the dwelling (19%); fear of falling due to weak structure (17%) and fear of rapist at 4%. Table 4-29 shows the respondents who felt insecure while using the facilities and the reasons for feeling insecure.

Table 4-29: Reasons for feeling insecure while using a sanitation facility

Parameter	**Description**	**No. of respondents**	**Percentage**
Do you feel insecure when using a household toilet or public sanitation? (N=155)	No	102	66%
	Yes	52	33%
	Did not answer	1	1%
	Total	**155**	**100%**
Reasons for feeling insecure while using the facility(N=52)	Afraid of darkness at the facility	19	37%
	Afraid of muggers	12	23%
	Distance from the dwelling	10	19%
	Fear falling inside due to weak structure	9	17%
	Afraid of rapists	2	4%

	Total	**52**	**100%**

Source: Own field data presentation

Table 4-30 shows the members of the household who felt insecure, where 52 respondents participated (participants were able to mention more than one member of the household). Asked about the members of the household who felt insecure, girls were reported as the most insecure with a score of 69% (36 out of 52)followed by women at 62% (32 out of 52) and boys at 42% (22 out of 52) while men were least insecure when using the facilities, mentioned by only 12 respondents.

Table 4-30: Household member who felt insecure when using a sanitation facility

Members of the household who felt insecure (N=52)	**Number of times mentioned**	**Number of respondents**	**Percentage of respondents**
Girls	36	52	**69%**
women	32	52	**62%**
Boys	22	52	**42%**
Men	12	52	**23%**

Source: Own field data presentation

Conditions of cleanliness of toilets/ latrines

The general conditions of most of the sanitation facilities (toilets or latrines)observedwere found to be between fair to poor (87%). Most of them lacked water and hand washing facilities such as taps and sinks (85%) and over 90% lacked soap for hand washing, mostly owing to the communal ownership/ and use of the

facilities. The level of hygiene was poor, making the facilities unattractive, especially for small children.

Table 4-31: Sanitary conditions of the toilets/ latrines

Indicator	Description	Frequency	Percentage
Condition of toilet (N=155)	Fair	82	53%
	Poor	52	34%
	Good	21	14%
	Total	**155**	**100%**
Presence of hand washing facilities (sinks, taps) (N=155)	No	131	85%
	Yes	24	15%
	Total	**155**	**100%**
Presence of soap near the hand washing sinks (sinks/ taps) N=155	No	144	93%
	Yes	11	7%
	Total	**155**	**100%**

Source: Own field data presentation

4.5 Household's knowledge and practices on sanitation

4.5.1 Respondents main environmental concern in the settlement

Solid waste and liquid waste pollution and poor drainage were mentioned as the main environmental concerns or priorities as cited by 60% of the respondents in the four wards. These were followed by inadequate supply of water at 22% and lack of improved sanitation at 10%. Poor planning/ housing and poor road, electricity although a major

characteristic of these settlements, were less mentioned by respondents, representing 6% and 3% respectively.

Table 4-32: Respondent's main environmental concern/priority

Environmental concern	No. of respondents	Percentage
Solid waste and liquid waste pollution	46	30%
Poor drainage	46	30%
Inadequate supply of water	34	22%
Lack improved sanitation facilities at household level	16	10%
Poor planning/ housing	9	6%
Poor roads, electricity network	4	2%
Total respondents	**155**	**100%**

Source: Own field data presentation

4.5.2 Respondents understanding of sanitation- disease linkages

Table 4-31 shows a summary of the respondent's knowledge of the causes of diseases in relation to sanitation (respondents were to mention as many as possible without influence). Asked about their knowledge on what causes diarrhea, 93 respondents (65%) cited germs to be the cause, followed by poor hygiene with 80 (52%), dirty food with 75 (48%), dirty water with 51 (33%), dirty hands with 33 (21%), flies with 15 (10%) and open defecation mentioned by only 10 respondents (6%). The data indicates that's most of the respondents had some background knowledge on the connection between diarrhea and general hygiene and sanitation with only about 10% indicating that they didn't know what caused diarrhea, believing it's part of child's growth or its caused by other causes

such as rain. Nevertheless, only 6% of the respondents cited the direct impact of faecal contamination resulting from open defecation. The respondent's understanding of sanitation and diseases linkages was a confirmation of some active public awareness and hygiene education programme, as reported by the one of the Key Informant i.e Public health officer in charge of water and sanitation.

Table 4-33: Respondent's knowledge of causes of diarrhea

Cause of diarrhea	No. of respondents citing	Total respondents	Percentage
Germs	93	N=155	65%
Poor hygiene	80	N=155	52%
Dirty food	75	N=155	48%
Dirty water	51	N=155	33%
Dirty hands	33	N=155	21%
Flies	15	N=155	10%
Open defecation	10	N=155	6%
Other	8	N=155	5%
Do not know	4	N=155	3%
Part of child's growth	3	N=155	2%
Rain	3	N=155	2%

Source: Own field data presentation

4.5.3 Respondents knowledge of how to stop diarrhea

Table 4-34 show a summary of respondent's response on their knowledge on how diarrhea can be prevented. The interview question on the respondent's knowledge on how diarrhea can be prevented had 62 (40%) of the respondents mention proper food preparation, followed by drinking clean water with 59 (38%), washing hands with water and soap by52 respondents (34%), covering food by 44 respondents (28%) and treating water by 39 (25%). No open defecation and latrine use where however among the least mentioned at 15% and 13% respectively, an indication of a gap between knowledge of causes of diarrhea and practices to prevent diarrhea.

Table 4-34: Respondent's knowledge on how diarrhea can be prevented

Respondent's knowledge on how diarrhea can be prevented	**No. of respondents citing**	**Total Respondents**	**Percentage**
Prepare food properly (cooking, washing)	62	N=155	40%
Drink clean water	59	N=155	38%
Wash hands with water and soap/ash	52	N=155	34%
Covering food	44	N=155	28%
Treating water	39	N=155	25%
Other	28	N=155	18%
No open defecation	23	N=155	15%
Store water safely	22	N=155	14%
Latrine use	20	N=155	13%
Do not know	7	N=155	5%

Prayer	1	N=155	1%

Source: Own field data presentation

4.5.4 Respondent's sanitation and hygiene practices

On household's sanitation and hygiene practices, handwashing before eating was the most mentioned as the key times when the respondent's washed their hands, as cited by 147 out of 155 respondents (95%) followed by washing hands after visiting a toilet/ latrine by 112 respondents (72%) and washing hands after eating by 100 respondents (65%). This is an indication that the majority of the respondents were aware of the significance of transmission of diseases from toilets to food through hands. Nevertheless, washing of hands before food preparation, before feeding a child and after handling baby's diapers/ faeces were less mentioned at 21%, 18% and 10% respectively, which is an indication of possible avenues of food contamination and high incidences of diarrhea in under 5 children.

Table 4-35: Respondent's sanitation and hygiene practices

Handwashing practice (N=155)	No. of respondents	Total respondents	Percentage
Before eating	147	N=155	95%
After latrine use	112	N= 155	72%
After eating	100	N= 155	65%
Before food preparation	32	N= 155	21%
After handling rubbish	28	N= 155	18%
Before feeding child	28	N= 155	18%

After handling baby's diaper/feaces	15	N= 155	10%
Other	13	N= 155	8%
After handling animals	1	N= 155	1%

Source: Own field data presentation

Handwashing with soap practices

Use of soap during handwashing was found to be practiced by 56% of the respondents while 44% of the respondents used water only for hand washing. This is an indication of knowledge and practice gap, which can hinder complete elimination of diarrhea and other water-borne diseases at household level.

Table 4-36: Respondent's use of soap during hand washing

Hand washing practice (N=155)	Frequency	Percentage
Water &Soap	87	56%
Water only	68	44%
	155	100%

Source: Own field data presentation

Water treatment practices

The study found out that 67% of the respondent's households didn't practice water treatment, albeit the unhygienic conditions where the water is obtained. Most of the water in slums is highly contaminated with faecal matter owing to lack of improved

sanitation facilities and poor drainage resulting to high incidences of diarrhea, worm's infections, skin diseases and other water-borne/ water washed and water-related diseases. The data is as summarized in table 4-37.

Table 4-37: Respondent's household practices on water treatment

Do you treat water? (N=155)	Frequency	Percentage
No	104	67%
Yes	51	33%
	155	100%

Source: Own field data presentation

4.6 Respondent's perception of the effects of poor sanitation access to their livelihoods.

Lack of improved sanitation facilities (poor sanitation access)was noted to have multiple effects on households. Of the 77 households who didn't have sanitation facilities at their dwelling, 35 of them (46%) indicated that it had some financial effectson the household's income as they had to pay for to get the services at a public facility, while another 23 (30%) more reported that lack of sanitation had an impact on their health through diarrhea and other water born-related diseases resulting from environmental

pollution. Further, related to households livelihoods, 14% reported that lack of sanitation facility resulted in time wastage and hence loss of income owing to lack of convenience of having the facility at their dwelling. Table 4-38 shows a summary of the respondent's perception of the effect of poor sanitation access to their livelihood.

Table 4-38: Summary of the effects of lack of a sanitation facility to households

Effects of lack sanitation on households (N=77)	**Number of respondents**	**Percentage**
Pay more for sanitation access	35	46%
Infected by diarrhea and other water-borne diseases.	23	30%
Wastage of time/ loss of income	11	14%
Environmental pollution	5	6%
Threat due to insecurity	3	4%
Total	**77**	**100%**

Source: Own field data presentation

Lack of a sanitation facility at a household'sdwelling also exposed different members of the household to security threats such as thefts, rape and physical harm as reported by 4% of the respondents without a toilet inside or near their dwelling.

4.6.1 Cost implications of lack of sanitation facility at household dwelling

Households without a sanitation facility (toilet or latrine) within their dwelling indicated to incur some cost to cater for sanitation access. Overall, sanitation access expenditure

was estimated to constitute about 1.4% of the average household's expenditure (Table 4.15, 4-16). Majority of the households without a sanitation facility indicated that they mostly used a public facility as cited by 45% of the respondents. This was done on a pay-per-use basis, as indicated by 99% of those using public toilets. On the actual household expenditure on toilet/ latrine access, 94% of the respondents using public toilets reported to have been spending Ksh. 500 and below while about 6% spend Ksh. 500 and above as per the table below.

Table 4-39: Households who paid for public sanitation

If a public sanitation facility, do you pay for use of the facility? (N=71)				
	No. of respondents	**Percent**	**Valid Percent**	**Cumulative Percent**
No	1	1%	1%	1%
Yes	70	99%	99%	100%
Total	71	100%	100%	

Source: Own field data presentation

Table 4-40: Respondent's household's direct expenditure on public toilets

If a public sanitation facility, how much do you spend per month for sanitation? (N=70)				
	No. of respondents	**Percent**	**Valid Percent**	**Cumulative Percent**
500 and below	66	94	94	94

501-1000	3	4	4	98
1001-1500	1	2	2	100
Total	70	100	100	

Source: Own field data presentation

4.6.2 Respondents perception of the relationship between poor sanitation access and incidences of diarrhea and other water-borne diseases

Lack of improved sanitation was said to contribute to incidences of diarrhea and other water-borne diseases. Table 4-41 gives a summary of common diseases as reported by the 155 respondents in the study area. Diarrhea scored highest as the most prevalent disease in the four wards, as mentioned 90 times (58% of respondents) followed by malaria mentioned 70 times (45%) and Cholera 65 times (42%). The sum total of all water-borne and sanitation-related diseases (diarrhea, Cholera, typhoid, amoeba and dysentery) as mentioned by respondents was 201 times with a total score of 66% of all responses.

Table 4-41: Summary of common diseases as reported by respondents

Prevalent Disease	No of times mentioned	Total number of respondents	Percentage
Diarrhea	90	N=155	58%
Malaria	70	N=155	45%
Cholera	65	N=155	42%
Airborne diseases (e.g. common colds, flu etc)	25	N=155	16%

Typhoid	22	N=155	14%
Amoeba / intestinal worms	17	N=155	11%
Pneumonia	8	N=155	5%
Dysentery	7	N=155	5%

Source: Own field data presentation

On diarrhea incidence in the four wards, at least 28% of the respondents reported an incident of diarrhea within a month before the date of the data collection. The highest percentage of those byaffected were persons aged between 18-59 years at 49% followed those aged between 0-5 years and 6-17 years each at 26%.

Table 4-42: Diarrhea incidence rate and age brackets

Parameters	**Incidences**	**No. of respondents**	**Percentage**
Diarrhea incidence (N=155)	No	112	72%
	Yes	43	28%
	Total	**155**	**100%**
Age brackets (N=43)	18-59 yrs old	21	49%
	0-5 yrs old	11	26%
	6-17 yrs old	11	26%
	Total	**43**	**100%**

Source: Own field data presentation

On diarrhea-related mortality in the area of study, at least 2 people were reported to have passed away a month before the study, one aged between 0-5 years and another 6-17 years.

Table 4-43: Diarrhea mortality rate and age brackets

Indicator	Description	Frequency	Percentage
Diarrhea mortality	No	153	99%
	Yes	2	1%
	Total	**155**	**100%**
Diarrhea mortality and Age brackets of those affected.	Not Applicable	153	99%
	0-5 yrs old	1	1%
	6-17 yrs old	1	1%
	Total	**155**	**100%**

Source: Own field data presentation

4.6.3 Medical data evidence on the prevalence of diarrhea and sanitation-related diseases in the study area.

Under 5 morbidity rate in the four wards

Medical data obtained from four medical facilities of health summing up top ten diseases in the study area for 6 months (September 2017 – March 2018), for under 5 years children indicated that Upper Respiratory Tract infection-URTI was the leading disease in all the facilities adding upto about 6,760 cases followed by diarrhea (3,017 cases) and Pneumonia with 1,039 cases. Other water and sanitation-related diseases such as skin infections, eye infections and intestinal worms are also very prevalent in the area, ranked 4^{th}, 6^{th} and 7^{th} respectively. Lack of improved sanitation (together with water and proper hygiene) is arguably the second leading risk factors and contribution to morbidity for under 5 years in the study area.

Table 4-44: Top 10 Diseases in Mathare Slums - Under 5 years

		Huruma Lions Health Centre	Mathare Police Deport	Upendo Dispensary	SHOFCO medical clinic	Total	Rank
1	Upper Respiratory Tract infection-(URTI)	2,924	750	900	2186	6,760	1
2	Diarrhea	609	253	551	1,604	3,017	2
3	Pneumonia	0	2	258	779	1,039	3
4	Skin infections	149	119	154	407	829	4
5	Malaria	14	3	50	442	509	5
6	Eye infection	40	17	116	169	342	6
7	Intestinal worms	29	93	151	36	309	7
8	Urinary Tract infections	8	3	91	97	199	8
9	Sexually transmitted Infections	0	20	21	21	62	9
10	Violence related injuries	5	0	0	0	5	10

Source: Huruma Lions Health Centre, Mathare police depot, Upendo Dispensary, and SHOFCO medical clinic (MOH-705A- Outpatient under 5 yr. summary)

Over 5 morbidity rate in the four wards

The over 5 years medical data obtained from the four medical facilities of health summing up top ten diseases in the study area for 6 months (September 2017 – March 2018), indicated that Upper Respiratory Tract infections-URTI was the leading disease in all the facilities adding up to about 8,023 cases followed by Pneumonia (1,707 cases)

and Diarrhea with 1,488 cases. Sexually transmitted infections and Urinary tract infections were significant for over 5 years both contributing a total of 2,105 cases. Lack of improved sanitation (together with water and proper hygiene) remains a major risk factor and contribution to morbidity for over 5 years in the study area.

Table 4-45: Top 10 Diseases in Mathare Slums - Over 5 years

		Huruma Lions Health Centre	Mathare Police Depot	Upendo Dispensary	SHOFCO medical clinic	Total	Rank
1	Upper Respiratory Tract infection- (URTI)	4351	659	824	2,189	8,023	1
2	Pneumonia	0	13	299	1395	1,707	2
3	Diarrhea	94	145	417	832	1488	3
4	Sexually transmitted Infections	45	40	116	853	1054	4
5	Urinary Tract infections	50	46	112	843	1051	5
6	Malaria	33	21	27	648	729	6
7	Skin infections	91	135	42	367	635	7
8	Eye infection	12	12	117	185	326	8
9	Intestinal worms	34	173	12	97	316	9
10	Violence related injuries	32	6	0	154	192	10

Source: Huruma Lions Health Centre, Mathare police depot, Upendo Dispensary, and SHOFCO medical clinic (MOH-705B- Outpatient over 5 yr. summary)

4.7 Chapter Summary

Chapter 4 provides the analysis and presentation of collected data organized in to three main objectives of the study: Objective 1 where data on sanitation access in the four wards is analysed and presented; objective 2 summarizing the data and findings on knowledge and practices on sanitation and hygiene in the area of study; and objective 3 presenting analysed data and findings on the effects of sanitation access to household's livelihoods.

CHAPTER FIVE: SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The study assessed the sanitation access and its effect on household's livelihood in Mathare slums, Nairobi County. This chapter presents a summary of the major findings, conclusions, implications and recommendations from the study.

5.1 Summary of the major findings

This section provides a summary of the study findings as discussed in chapter four based on the topic, the research objectives and research questions that were responded to by the respondents during the data collection and other secondary data obtained from medical facilities of health.

5.1.1 Households' access to sanitation

The study established that only 50% of the households had an access to ahousehold sanitation facility in the study area. The other population either used a public toilet (45%), neighbour's toilet (4 %) orplastic bag/ bucket (1%). Most of the household's sanitation facilities areshared as reported by 83% of the respondents with household sanitation access, with only 17% of the household's having a private sanitation facility. Multiple households shared a single facility, with 78% of the facilities being shared by over 5 households.

Pour-flush toilets were the most commonly sanitation technological optionused in the study area, as reported by over 37% of the respondents. Majority of the sanitation facilities available can be classified as improved (44%),with another 6% composed of traditional pit latrines and others.On sewer connection, 40% of the respondents had

connections to city sewer network while 4% were discharging into drainage channels or creeks. Another 6% were using used onsite sanitation disposal system such as septic tanks and pit latrines.

On distance of sanitation facility to the household's dwelling, 10% of the respondents had their sanitation facilities within their dwelling while another 37% had their sanitation facilities within 30m from their dwelling. Only 3% of the respondents had their sanitation facilities located more than 50m from the household dwellings. Sanitation access was found to differ from ward to another depending on the settlement/shelter type. The highest sanitation coverage was found in areas with more permanent housing such as Ngei (93%) and Mlango Kubwa (46%) while the coverage was lowest in Mabatini (33%) and Hospital ward (8%), where most of the houses had walls types/ roof types made of were iron sheets informally planned and constructed.

The overall approval rate of the sanitation facilities by households was low, the reasons being the use of the facility by many people, hence lack of privacy, convenience and inability to keep the facilities clean. The second in the rank for disapproval was the distance of the facility from household's dwelling which exposed the household's members to insecurity at night. Other reasons were the non-availability of water at the facility, the design/ technology and insecurity while using the facilities.

Financing of sanitation facilities

The study found out that 98% of the households were renters hence the landlords were the main financiers of the sanitation facilities. The financing role of individual

households was minimal, while the private sector and government roles in financing household sanitation was only 1%.

Discussion: Role of Institutions and legal framework in the provision of sanitation services

Sanitation development was found to be directly linked to Shelter development in Mathare sub-county, which is influenced by the institutional support and control, through approval of plans, designs and construction standards. Ngei ward, like the neighbouring upgraded Mathare 4A, was found to have a strong institutional support and control from the county government, where all new developments were approved before development. This resulted in a better organized and properly planned settlement incorporating basic public health amenities (such as toilets). Mabatini, Hospital and Mlango Kubwa wards, on the other hand, were found to have had a weak institutional and policy control (by national and county government), except for the provincial administration (office of the president) who was found to have grassroots representation. Shelter development, in this case, consists of informal, unregistered and unregulated housing and service providers, who are mainly for profit, and often avoid essential services such as sewage and wastewater management (Otiso, 2000) (Otiso, 2003). The informal nature of development was therefore found to be a hindrance in enforcing public health standards in the study area.

5.1.2 Household's knowledge and practices on sanitation

Sanitation ranked fourth in terms of the respondent's priority concerns after solid waste, drainage and liquid waste and water supply. The research found out that majority of the

households had some background knowledge on the connection between diarrhea and general hygiene and sanitation with only about 10% indicating that they didn't know what caused diarrhea. Nevertheless, only 6% of the respondents cited open defecation which is the main cause of faecal contamination into water bodies and the environment. On how to prevent diarrhea and other sanitation-related diseases, "No open defecation" and "latrine use" were among the least mentioned at 15% and 13% respectively, an indication of knowledge and practice gaps on the causes of diarrhea and practices to prevent it.

On practices sanitation and hygiene practices such as handwashing with soap and water treatment, handwashing before eating, after defecation and after meals were the most common practices as mentioned by 95%, 72% and 65% of the respondents. On water treatment practices, only about 33% of the respondents confirmed treating their water for domestic purpose, albeit the poor sanitary conditions in the area.

5.1.3 Respondents perception of the effects of lack/poor of sanitation on their livelihoods

Lack of improved sanitation and proper hygiene was perceived to have multiple effects on household's livelihoods. Economically, the majority of the households (94%) without sanitation facilities in their dwelling indicated to be spending about Ksh 500, equivalent to about 1% of their income to pay for sanitation at a public toilet on a pay-per-use basis.

On health, both the data from the respondents at the household level and medical data from the four mainhealth facilities indicateddiarrheaand other sanitation-related diseases

to be the second leading risk factors and contribution to morbidity for under 5 years, and the third leading risk factors and contribution to morbidity for over 5 years in the study area. Further, households were found to spend at least 5% of their income per month to access medical services, with the majority of the ailments resulting from lack of improved sanitation, water and hygiene.

5.2 Conclusion of the study

The purpose of the study was to assess sanitation and its implication on households' livelihoods in Mathare sub-county, Nairobi County, focusing on four wards namely: Mabatini, Ngei, Hospital and Mlango Kubwa wards which cover the greater Mathare slums. The study sought to establish current sanitation access in Mathare slums, knowledge and practices gaps in Mathare slums and to establish the effect sanitation access on household's livelihood in Mathare slums. It was established through the literature review that sanitation access impacts on household's livelihoods and through analysis of data from the field.

The study found out that sanitation coverage in the informal settlements is still low despite the national governments and county government's efforts to improve sanitation access in these areas. The study established that only 50% of the households had access to a sanitation facility (47% to an improved/ limited sanitationaccess) atthe household level, which are,however,shared by multiple households. Households without toilets at household level primarily used public toilets, which were found to be accessible during the day time, forcing the households to use buckets, plastic bags or practice open defecation.Development of public sanitation is,therefore, a temporal solution to

sanitation access for households and therefore, not considered as improved sanitation (World Bank, 2013).

Analysed data obtained from households and medical records from the four main health facilities in the area confirmed that diarrhea and other sanitation and hygiene-related diseases were the second leading contributor to morbidity rate for under five years and the leading third cause of morbidity for over five years in the study area. Frequent hospitalization impacted negatively to household's income through reduced productivity, increased expenditure due to medication, reduced asset base and saving due to a limited choice between purchasing food, medicine, paying for sanitation access and purchasing of fixed assets.Sanitation access, was therefore, found to impact directly on household's livelihoods through direct costs to pay for sanitation access, cost of medication and reduced productivity due to sickness.

5.3 Implications of the Study

The study implies that a lot still needs to be done by relevant stakeholders to achieve a universal access to sanitation for all as per the SDG goal on sanitation, especially for the bulk of the population living in urban, informal settlements. The Government of Kenya through the Ministry of Health and Sanitation developed a new sanitation and hygiene policy in 2016, which was aimed at addressing the bottlenecks towards the achievement of universal access to sanitation for all. The full operationalization of this policy is exigent, which requires the necessary financial support and coordination of all actors. The necessary institutional support needs to be actualized at all levels, especially in the informal settlement where sanitation services are poor and uncoordinated. All relevant

stakeholders, including the beneficiary households, should be involved in solving the sanitation challenges in the study area.

5.4 Recommendations of the study

The following recommendations are made based on the findings from this research, targeting policymakers, and development partnersand slums residents:

Objective 1 and 2: Recommendation on measures for increased access to sanitation at household level and enhancing knowledge and practices on sanitation

1. Controlled development is one of the most effectiveways of increasing sanitation coverage in the urban informal settlements. All new buildings in the area should be approved and be constructed in strict adherence to urban public health standards. Thesemeasureswould ensure that all buildings, including temporary structures, have a sanitation facility, to serve its occupants. Therelevant bodies such as the County Government should,therefore,increase institutional support through enhanced capacity on the ground (in terms of skills and numbers) to ensure full compliance.
2. Landlords and landowners are solely responsible for the construction of sanitation facilities in the area.Innovative and attractive strategies targeting landlords should,therefore, be put in place to enhance sanitation and hygiene services in the urban informal settlements.Such strategies include development of technologies which converts toilet waste (faecal sludge) to organic fertilizers (Sanergy model) (Mark O'keefe, 2015), energy from charcoal briquettes (Sanivation technology)and biogas converters or bio-digesters. These can be financed throughprivate-private partnership, or through the provisionof micro-creditstargeting the landlords and developers.

3. Sanitation-related diseased can significantly be reduced through improved personal hygiene, such as the practice of handwashing with soap at key times, elimination of open defecation and water treatment. Public health officers, NGOs and community leaders should, therefore, develop and implement custom-made urban community-led total sanitation (Urban CLTS) programmes to tackle open defecation and enhance personal hygiene awareness at household level in the four wards.

Objective 3: Recommendation on measures to mitigate the effects of poor sanitation access on household's livelihoods

1. Sanitation development should be linked to household's livelihoods. This includes adoption of strategies such as: training of artisans and household members on appropriate technologies; development of sanitation systems with added values such as biogas,charcoal briquettes, which can be sold cheaply to slums dwellers;and development of public sanitation facilities with additional services such as bathrooms, water kiosks, and retail shops for household goods. Organized community groups such as youth and women groups should be involved in the operation and management of public toilets, to enable them to generate some income.
2. Slum-upgrading programmes should be up-scaled, targeting the areas with poor sanitation access such as Hospital ward and Mabatini wards. "State, voluntary and private sector model" (Otiso, 2003) have shown success in the neighbouring settlements such as Mathare 4A and Kibera upgrading programme. In Mathare 4A, the implemented programme significantly improved the living conditions for over 30,000 persons, through construction of 8000 rooms, business stalls, kindergartens,

installation of streetlights, improved road networks, reticulation of water and sewerage system, construction of one “wet-core” (shower-toilet-washing slab) per 10 households and a water drainage system (Otiso, 2003).

5.5 Recommendation for Further for Research

The following are the recommendations for further research:

1. Assessment of the effectiveness of WASH interventions such as Community Led Total Sanitation (CLTS) in urban areas;
2. Assessment of the impacts of improved sanitation to school going children in urban slums;
3. Assessment of the impacts of combined effects of water, sanitation and hygiene to household’s livelihoods in slums;

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APPENDICES

Appendix I: Questionnaire

Appendix: II: A letter from institution (St. Paul's University)

Appendix III: A research letter of authorization from NACOSTI

Appendix IV: Research permits from NACOSTI for carrying out research

Appendix V:Research Authorization to collect data within Nairobi county medical facilities of Health.

Appendix VI:Data analysis on household expenditure on different aspects

APPENDIX I: QUESTIONNAIRE
SANITATION AND HYGIENE ASSESSMENT IN MATHARE SLUMS, NAIROBI COUNTY

PART 1: HOUSEHOLD QUESTIONNAIRE
BASED ON MOBILE KOBO TOOLKIT DATA COLLECTION

A. RESPONDENT'S BIODATA

1. County Name _____
2. Ward Name_____
3. GPS coordinates _____
4. Name of the Data Collector_____
5. Respondent No._____
6. Gender of the respondent_____
   - Male
   - Female
7. Age of the respondent _____
8. Age bracket of the respondent
   - 12-17
   - 18-24
   - 25-40
   - 41-59
   - Over 60 years
9. Marital status of the respondent
   - Single
   - Married
   - Separated/ Divorced
   - Widow/er
10. Educational background of the respondent?
    - Can't read/ write
    - Class 8
    - O level /a level/ Form 4
    - College (certificate/ diploma)
    - Graduate (degree and above)
11. Who is the respondent?
    - Husband
    - Wife
    - Son
    - Daughter
    - Bro/Sister to wife or Husband
    - Grandparent
    - Servant
    - Other (specify)

B. RESPONDENT'S HOUSEHOLD SOCIAL ECONOMIC DATA

12. What is the gender/sex of the household head?
    - □ Male
    - □ Female
13. How many people live in the household……?
14. What number of the household members are:
    (a) Age brackets of the household members of 0-5 yrs_____
    (b) Age brackets of the household members 6-17 yrs_____
    (c) Age brackets of the household members 18-59 yrs _____
    (d) Age brackets of the household members 60+ yrs_____
15. What is the occupation of the household head?
    - □ Unemployed
    - □ Unskilled
    - □ Semi-skilled
    - □ Skilled worker
    - □ Farmer
    - □ Shopkeeper
    - □ Clerical
    - □Medium level professional (Teachers, nurses etc)
    - □High-level professionals (Engineers, doctors, lecturer etc)
16. What is the level of income of the household head?
    - □Less than 3000
    - □ 3001-5000
    - □ 5001-7500
    - □ 7501-10000
    - □ 10001-1500
    - □ 15001-20000
    - □ 20001-25000
    - □ 25001-35000
    - □Over 35,000
17. What is the household monthly expenditure on:
    (a) What is the household's monthly expenditure on Rent?
    (b) What is the household's monthly expenditure on Food?
    (c) What is the household's monthly expenditure on Healthcare?
    (d) What is the household's monthly expenditure on water?
    (e) What is the household's monthly expenditure on latrine access?
    (f) What is the household's monthly expenditure on school fees?
    (g) What is the household's monthly expenditure on Electricity?
    (h) What is the household's monthly expenditure on transport?
    (i) What is the household's monthly expenditure on Security?
    (j) What is the household's monthly expenditure on others....?
18. What is your current status of residence?
    - □Privately owned
    - □Rented
    - □ Squatter

19. Shelter type/ Wall type/ roof type
    - Iron sheets/ informal settlement
    - Stone walled single unit with own compound
    - Stone walled/ multi-dwelling units

C. OBJECTIVE 1: SANITATION ACCESS INFORMATION

20. Does your family have an access to a sanitation facility (toilet, latrine)?
    - Yes
    - No
21. If YES, which type of sanitation facility?
    - Traditional latrine/ timber slab and iron sheet walls
    - Pit latrine with slab/stone walls
    - Pour Flush toilet
    - Water Closet Toilet
    - Public toilet
22. Where is the waste from the sanitation facility discharged?
    - Septic tank
    - Sewer system
    - Drainage/ river
23. If YES, who helped you to construct the sanitation facility?
    - Self
    - NGO
    - Landlord
    - Local authority/ Government
24. If YES, how far is the sanitation facility from house?
    - Inside the house
    - Within 30 metres
    - More than 31metres
25. Is the sanitation facility shared?
    - Yes
    - No
26. If sharing a sanitation facility with others, how many families are sharing?
    - 2-4 families
    - 5-7 families
    - More than 7 families
27. Are you satisfied with the sanitation facility in place?
    - fully satisfied
    - not satisfied
28. What is the reason for not being satisfied?
    - Facility not well constructed/ designed
    - Facility used by many people
    - Non availability of Water
    - Facility not secure
    - Facility very far away

29. If NO sanitation facility, where does your family go for defecation?
    - Public latrine
    - Neighbour latrine
    - Plastic bag
    - Dig a hole/cat hole
    - Creeks/canal/river
    - Bush/backyard/field
30. If NO sanitation facility, what is the main reason why your family does not have sanitation?
    - No space for construction
    - Defecation is not an issue
    - It's expensive to construct a sanitation facility
    - A lot of space to defecate here
    - Not a priority
    - Rented house with no sanitation facility

D. OBJECTIVE 2: KNOWLEDGE AND PRACTICES ON SANITATION/ HYGIENE

E. What do you think is the cause of diarrhea? (Tick all the respondent mentions but don't influence)
    - Rain
    - Germs
    - Flies
    - Dirty hands
    - Dirty food
    - Dirty water
    - Part of child's growth
    - Poor hygiene
    - Open defecation
    - Black magic/witchcraft
    - Do not know
    - Other

F. How do you think diarrhea can be prevented? (Tick all the respondent mentions but don't influence)
    - Do not know
    - Latrine use
    - Covering food
    - Prayer
    - Drink clean water
    - Treating water
    - No open defecation
    - Store water safely
    - Prepare food properly (cooking, washing)

- Wash hands with water and soap/ash
- Wash hands with water and soap/ash
- Go to traditional healer
- Other

31. What do you usually do when a member of the family is having diarrhea? (ticks all that are mentioned)
    - No action
    - Give herbs
    - Buy medicine
    - Stop Feeding
    - Give ORS/SSS
    - Continue Feeding
    - Go to clinic/ health facilities
    - Go to traditional healer
    - Other (specify)

32. Kindly give me the key times when you usually wash your hands?
    - Before eating
    - After eating
    - After defecation
    - After latrine use
    - Before feeding child
    - After handling rubbish
    - After handling baby's diaper/faeces
    - Before food preparation
    - After handling animals
    - Other
33. What do you usually use in washing hands? (Tick the most commonly practiced)
    - Water only
    - Water & Sand/leaves
    - Water &Soap
    - Water & Ash
    - Other, specify
34. If the answer is 1(Water only), what is the MAIN factor that prevents your family from using soap?
    - Washing with soap takes time
    - Negligence/ laziness
    - Water alone cleanses the hand
    - Expensive to buy soap
    - Soap is not a practice even before
    - Other
35. OBSERVE: Is there any hand washing facility available around the home?
    - No available washing facility

- There are water and soap near or within the latrine (Only in households with latrine)
- There is ONLY water near or within the latrine (Only in household with latrine only)
- There are water and soap at designated hand washing area
- There is ONLY water at designated hand washing area.

36. Observe: Status and cleanliness of the sanitation facility?
    - Poor
    - Fair
    - Good
37. Observe: Is there a hand washing facility near the sanitation facility?
    - Yes
    - No
38. Is there a soap near the sanitation facility?
    - Yes
    - No

G. OBJECTIVE 3: EFFECTS OF LACK/ POOR SANITATION

39. How does lack of sanitation facility affect you?
    - Pay more for sanitation access
    - Threat due to insecurity
    - Environmental pollution
    - Infected by diarrhea and other water-borne diseases.
    - Wastage of time/ loss of income
40. If a public sanitation facility, do you pay for use of the facility?
    - Yes
    - No
41. If a public sanitation facility, how much do you spend per month on sanitation?
    - 0-500
    - 501-1000
    - 1001-1500
    - More than 1501
42. Do you or any member of your household feel safe when using the toilet or public facility at night?
    - Yes
    - No
43. If no why?
    - Distance from the household
    - Afraid of muggers
    - Afraid of rapists
    - Afraid of darkness at the facility
    - Fear falling inside due to weak structure.
44. If no which members feel not safe to use the facility?
    - Boys

- Girls
- Men
- Women

45. Which diseases are common in your settlement?
    - Diarrhea
    - Malaria
    - Dysentery
    - Typhoid
    - Pneumonia
    - Cholera
    - Amoeba / intestinal worms
46. In the last one month, has anyone in your family had a diarrhea? (Passing of stool 3 or more times, which is watery, bloody, mucoid or water-wash like)
    - Yes
    - No
47. If YES, how old is the family member who had diarrhea?
    - 0-5 yrs old
    - 6-17 yrs old
    - 18-59 yrs old
    - 60 yrs and above
48. Has anyone in your household passed away (died) due to diarrhea for the last 1 month? (Be sensitive/ courteous when asking this question)
    - Yes
    - No
49. If YES, how old was that member of the household?
    - 0-5 yrs old
    - 6-17 yrs old
    - 18-59 yrs old
    - 60 yrs and above

MEDICAL DATA

50. What are the top ten diseases treated in your facility for under 5 years;
51. What are the top ten diseases treated in your facility for over 5 years;

PART 1I: KEY INFORMANTS INTERVIEW QESTIONS

Sanitation

1. What are the main environmental and infrastructure concerns/ priority in the settlement? Rank them from 1-10
2. Where do most people go for defecation (get some defecation practices, percentage if possible)
3. What motivates people who have constructed their own latrines?
4. What prevents other families from having a latrine?
5. How can we motivate people to build latrine? What can be the best strategy?

6. How can the sanitation problem be resolved in the slums setup?
7. Are there risks/ threats in the use of current sanitation facilities/ defecation places? Who are threatened and by who?
8. How are people affected economically by poor of sanitation access?

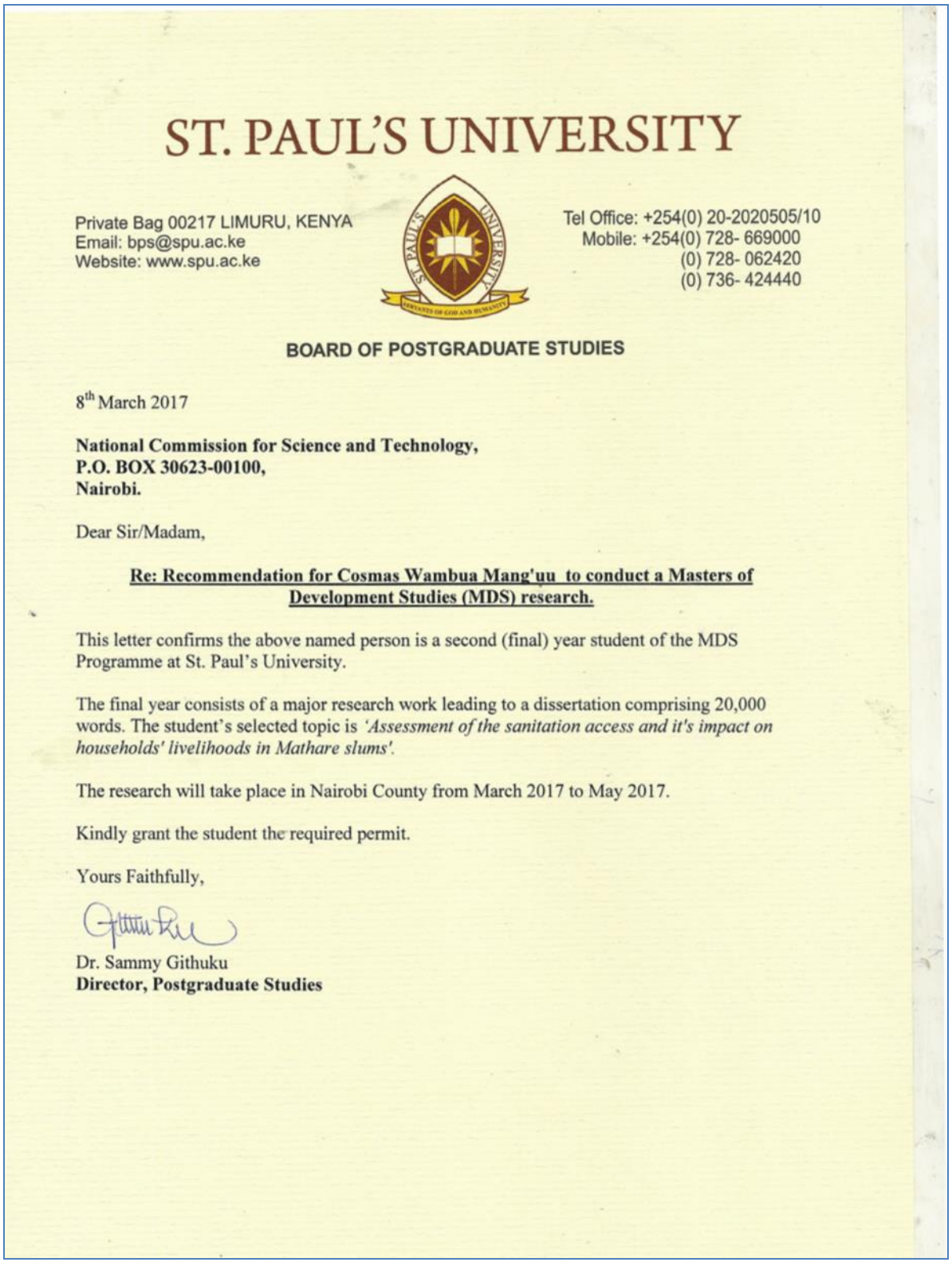
Hygiene

1. What are the key times that most people wash their hands?
2. What materials/ agents do most people use when washing their hands?
3. What do you believe are the benefits of washing hands at keys times with water and soap?
4. What are the reasons why others don't wash their hands with soap at key times?
5. How can you motivate people to wash their hand and soap at key times?

Water-borne/ Sanitation related diseases

1. Are there any cases of diarrhea/ Cholera for the last one month (get details of age?)
2. Has anyone passed/died due to diarrhea/ Cholera in the last one month? (And age)?
3. What do you believe is the cause of diarrhea?
4. What do you do when a member of your family gets diarrhea?
5. What can we do to prevent diarrhea?

Appendix: II: A letter from Institution (St. Paul's University)



ST. PAUL'S UNIVERSITY

Private Bag 00217 LIMURU, KENYA
Email: bps@spu.ac.ke
Website: www.spu.ac.ke

Tel Office: +254(0) 20-2020505/10
Mobile: +254(0) 728- 669000
(0) 728- 062420
(0) 736- 424440

BOARD OF POSTGRADUATE STUDIES

8th March 2017

National Commission for Science and Technology,
P.O. BOX 30623-00100,
Nairobi.

Dear Sir/Madam,

Re: Recommendation for Cosmas Wambua Mang'uu to conduct a Masters of Development Studies (MDS) research.

This letter confirms the above named person is a second (final) year student of the MDS Programme at St. Paul's University.

The final year consists of a major research work leading to a dissertation comprising 20,000 words. The student's selected topic is *'Assessment of the sanitation access and it's impact on households' livelihoods in Mathare slums'.*

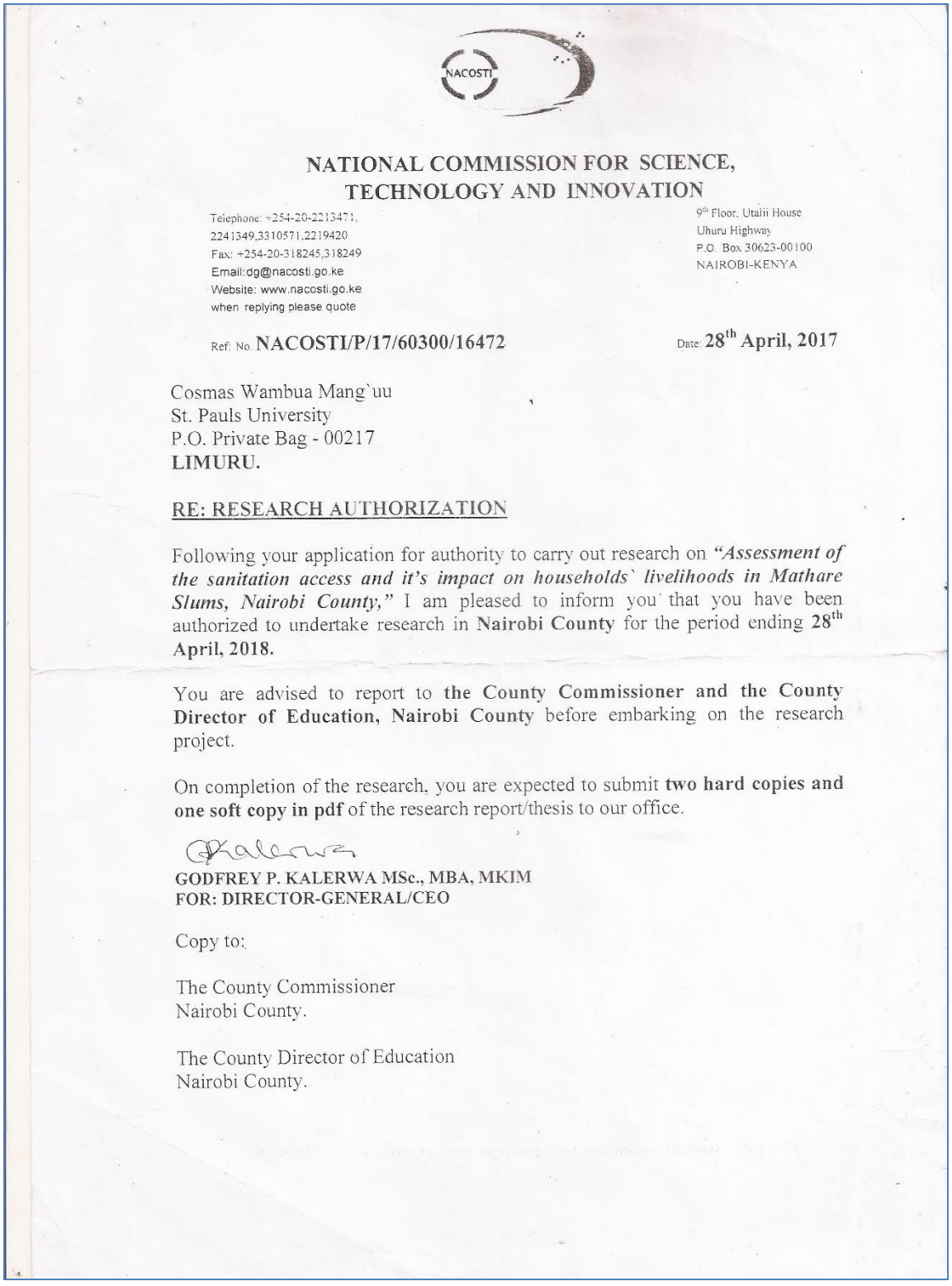
The research will take place in Nairobi County from March 2017 to May 2017.

Kindly grant the student the required permit.

Yours Faithfully,

Dr. Sammy Githuku
Director, Postgraduate Studies

Appendix III: A research letter of authorization from NACOSTI



NACOSTI

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

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/60300/16472**

Date: **28th April, 2017**

Cosmas Wambua Mang`uu
St. Pauls University
P.O. Private Bag - 00217
LIMURU.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Assessment of the sanitation access and it's impact on households` livelihoods in Mathare Slums, Nairobi County,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **28th April, 2018.**

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

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

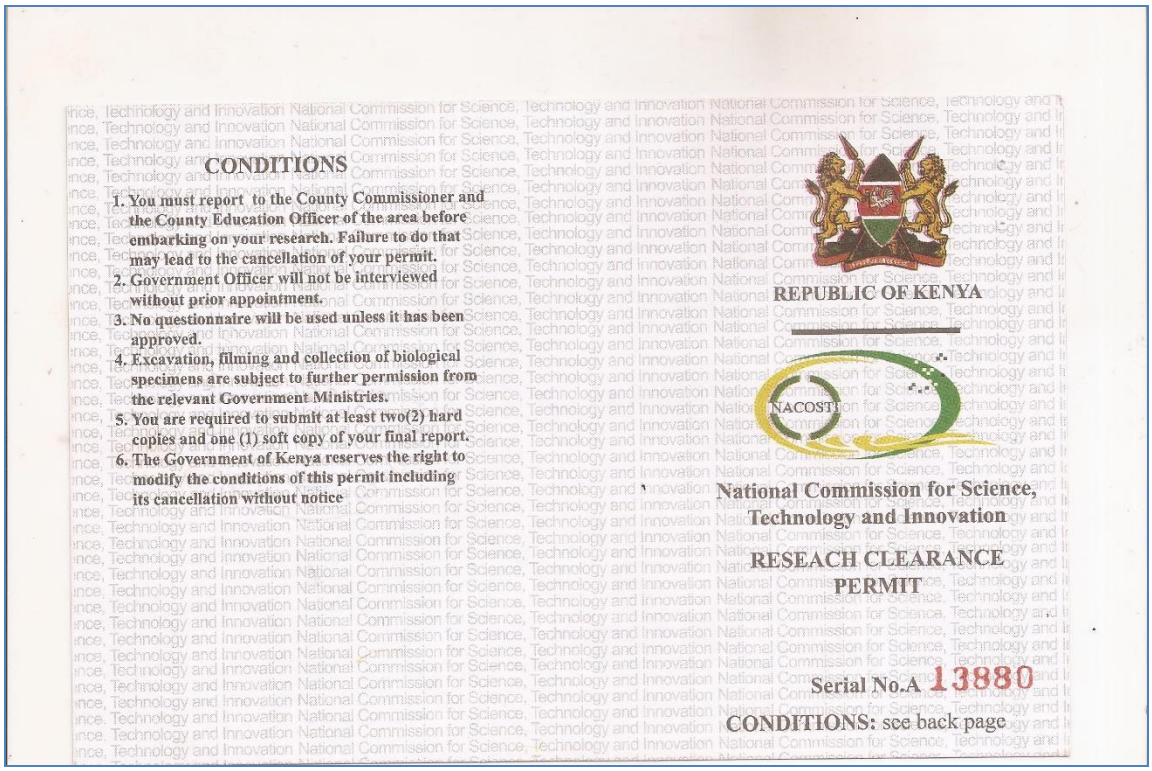
GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.

Appendix IV: Research permits from NACOSTI for carrying out research



CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officer will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

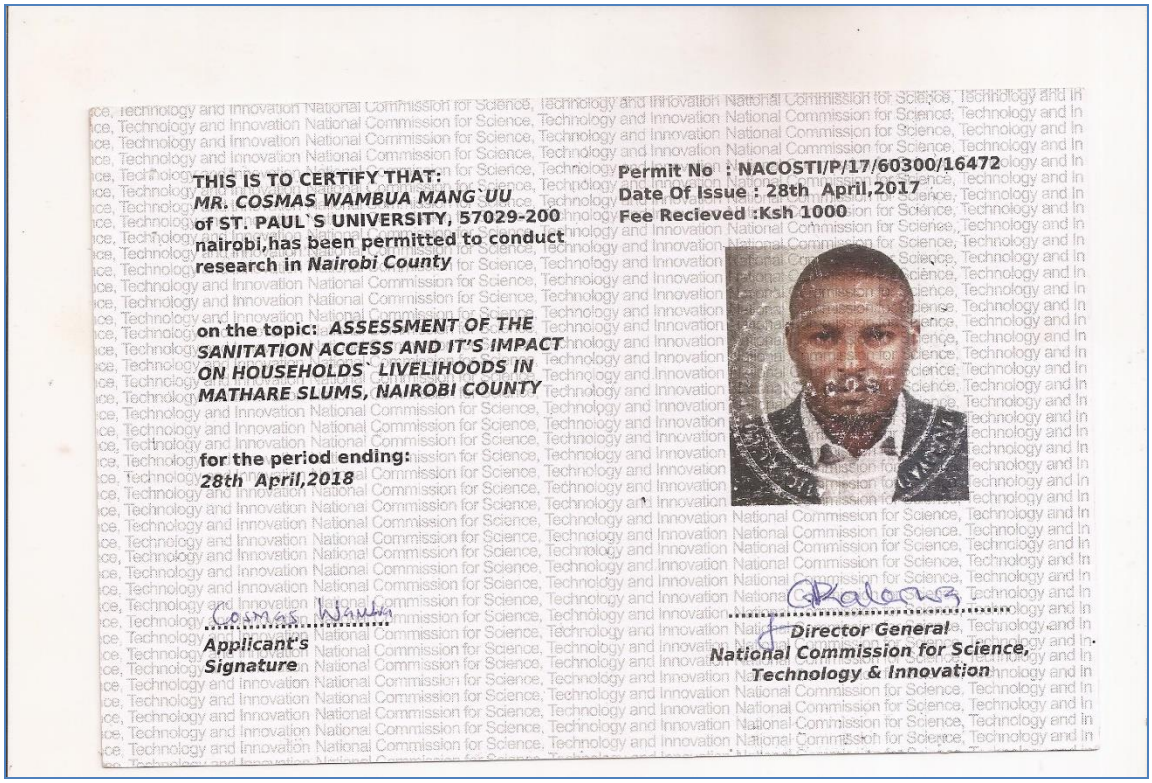
NACOSTI

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 13880

CONDITIONS: see back page



THIS IS TO CERTIFY THAT:
MR. COSMAS WAMBUA MANG`UU
of ST. PAUL`S UNIVERSITY, 57029-200
nairobi,has been permitted to conduct
research in *Nairobi County*

on the topic: *ASSESSMENT OF THE SANITATION ACCESS AND IT'S IMPACT ON HOUSEHOLDS` LIVELIHOODS IN MATHARE SLUMS, NAIROBI COUNTY*

for the period ending:
28th April,2018

Permit No : NACOSTI/P/17/60300/16472
Date Of Issue : 28th April,2017
Fee Recieved :Ksh 1000

Cosmas Wambua
Applicant's Signature

Director General
National Commission for Science, Technology & Innovation

Appendix V: Research Authorization to collect data within Nairobi county medical facilities of Health.

NAIROBI CITY COUNTY

Telephone 020 344194

Web: www.nairobi.go.ke

City Hall,
P. O. Box 30075-00100,
Nairobi,
KENYA.

COUNTY HEALTH SERVICES

REF: CHS/1/13/ (13) - 018

SUB - COUNTY MEDICAL OFFICER OF HEALTH
2 4 APR 2018
STAREHE & MATHARE

TO: COSMAS WAMBUA MANG'UU
ST. PAULS UNIVERSITY
P O PRIVA BAG
LIMURU

DATE: 23rd APRIL, 2018

RE: RESEARCH AUTHORIZATION FOR "ASSESSMENT OF THE SANITATION ACCESS AND ITS IMAPCT ON HOUSEHOLDS IN MATHARE SLUMS NAIROBI COUNTY".

Reference is made to a letter from the Director Human Resource Management

Ref. HRD/3/4/487/MWN/2018 dated 12TH March, 2018.

Authority is hereby granted to you to carry out research on **"Assessment of the Sanitation access and its Impact on Households in Mathare Slums Nairobi County".**

"Please note that your research runs for two-weeks w.e.f from 23rd April to 30th April, 2018.

During the course of your research you will be expected to adhere to the rules and regulations governing the Nairobi City County.

You will also be expected to submit a copy of your research project to the office of the undersigned.

By a copy of this letter, the SCMOH: Starehe, is requested to accord you the necessary assistance.

Research fee of five thousand Kenya shillings (5000) has been paid.

CHIEF ADMINISTRATIVE OFFICER

BUNICE MUSAU
CHIEF ADMINISTRATIVE OFFICER – (CHS)

Cc: - SCMOH – Starehe
SCHAO – Starehe

Appendix VI:Data analysis on household expenditure on different aspects

Table 1: Household's expenditure on rent

What is the household's monthly expenditure on Rent (N=151)					
Rent in Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
500	1	1	1	500	6,570,225
700	1	1	1	700	5,584,927
800	1	1	1	800	5,122,278
1,000	2	1	1	2,000	4,256,980
1,200	2	1	1	2,400	3,471,682
1,500	1	1	1	1,500	2,443,735
1,600	3	2	2	4,800	2,141,086
1,650	1	1	1	1,650	1,997,262
1,700	1	1	1	1,700	1,858,437
1,800	9	6	6	16,200	1,595,788
2,000	24	16	16	48,000	1,130,490
2,200	2	1	1	4,400	745,192
2,300	1	1	1	2,300	582,543
2,500	40	26	27	100,000	317,245
2,600	1	1	1	2,600	214,596
2,700	1	1	1	2,700	131,947
3,000	20	13	13	60,000	4,000
3,200	1	1	1	3,200	18,702
3,300	1	1	1	3,300	56,053
3,500	4	3	3	14,000	190,755
4,000	7	5	5	28,000	877,510
4,200	1	1	1	4,200	1,292,212
4,500	4	3	3	18,000	2,064,265
5,000	6	4	4	30,000	3,751,020
5,500	2	1	1	11,000	5,937,775
5,800	2	1	1	11,600	7,489,828
6,000	4	3	3	24,000	8,624,530
6,500	4	3	3	26,000	11,811,285
7,000	2	1	1	14,000	15,498,040
8,000	1	1	1	8,000	24,371,550
15,000	1	1	1	15,000	142,486,119
Total	**151**	**97**	**100**	**462,550**	**262,638,054**

Missing	4	3			
Total	155	100	Mean	3,063	
			SD	1,319	
			Mode	2,500	
			Median	2,500	

Table 2: Household's expenditure on food

What is the household's monthly expenditure on Food					
Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
150	2	1	1	300	16,918,799
240	1	1	1	240	16,186,514
500	2	1	1	1,000	14,162,026
600	1	1	1	600	13,419,377
1,000	5	3	3	5,000	10,648,779
1,400	2	1	1	2,800	8,198,182
1,500	8	5	5	12,000	7,635,533
1,600	1	1	1	1,600	7,092,883
2,000	14	9	9	28,000	5,122,286
2,500	6	4	4	15,000	3,109,039
3,000	24	16	16	72,000	1,595,792
3,500	8	5	5	28,000	582,546
4,000	15	10	10	60,000	69,299
4,500	8	5	5	36,000	56,052
5,000	18	12	12	90,000	542,805
6,000	13	8	8	78,000	3,016,312
6,500	1	1	1	6,500	5,003,065
7,000	3	2	2	21,000	7,489,818
7,500	1	1	1	7,500	10,476,572
8,000	4	3	3	32,000	13,963,325
9,000	14	9	9	126,000	22,436,831
10,000	2	1	1	20,000	32,910,338
13,000	1	1	1	13,000	76,330,857
Total	**154**	**99**	**100**	656,540	276,967,031
Missing	1	1			
Total	155	100	Mean	4,263	

SD	1,341
Mode	3,000
Median	4,000

Table 3: Household's expenditure on health

What is the household's monthly expenditure on Healthcare					
Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
20	3	2	4	60	640,572
50	1	1	1	50	593,450
100	11	7	13	1,100	518,914
150	2	1	2	300	449,379
200	10	7	12	2,000	384,843
300	8	5	10	2,400	270,772
350	1	1	1	350	221,236
400	1	1	1	400	176,700
500	22	14	26	11,000	102,629
600	1	1	1	600	48,557
700	1	1	1	700	14,486
750	1	1	1	750	4,950
800	1	1	1	800	414
900	1	1	1	900	6,343
1,000	8	5	10	8,000	32,272
1,500	1	1	1	1,500	461,914
2,000	5	3	6	10,000	1,391,557
2,500	2	1	2	5,000	2,821,200
3,500	1	1	1	3,500	7,180,486
4,500	1	1	1	4,500	13,539,772
5,000	1	1	1	5,000	17,469,414
10,000	1	1	1	10,000	84,265,843
Total	**84**	**54**	**100**	**68,910**	**130,595,703**
Missing	71	46			
Total	155	100	Mean	820	
			SD	1,247	
			Mode	500	
			Median	500	

Table 4: Household's expenditure on water

What is the household's monthly expenditure on water					
Kshs (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
100	20	12	14	2,000	166,427
120	1	1	1	120	150,509
140	1	1	1	140	135,391
150	23	15	17	3,450	128,131
180	1	1	1	180	107,554
200	18	12	14	3,600	94,836
250	2	1	2	500	66,541
300	18	12	14	5,400	43,245
350	1	1	1	350	24,950
360	1	1	1	360	21,891
400	3	2	2	1,200	11,654
500	10	7	8	5,000	63
600	8	5	6	4,800	8,472
700	1	1	1	700	36,881
750	1	1	1	750	58,586
800	1	1	1	800	85,291
900	7	5	5	6,300	153,700
1,200	3	2	2	3,600	478,927
1,500	7	5	5	10,500	984,154
1,800	1	1	1	1,800	1,669,381
3,000	2	1	2	6,000	6,210,291
3,500	1	1	1	3,500	8,952,336
6,000	1	1	1	6,000	30,162,563
Total	**132**	**85**	**100**	67,050	49,751,774
Missing	23	15			
Total	155	100	Mean	508	
			SD	614	
			Mode	150	

Median	300

Table 5: Household's expenditure on Latrine use

What is the household's monthly expenditure on latrine access					
Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
50	6	4	8	300	15,160
100	48	31	60	4,800	5,347
150	13	8	16	1,950	535
200	4	3	5	800	722
300	2	1	3	600	16,097
400	1	1	1	400	51,472
500	1	1	1	500	106,847
600	3	2	4	1,800	182,222
1,200	1	1	1	1,200	1,054,472
1,500	1	1	1	1,500	1,760,597
Total	**80**	**52**	**100**	13,850	3,193,473
Missing	75	48			
Total	**155**	**100**	Mean	173	
			SD	200	
			Mode	100	
			Median	100	

Table 6: Household's expenditure on school fees

What is the household's monthly expenditure on school fees					
Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
167	1	1	1	167	5,565,181
300	6	4	6	1,800	4,955,359
350	2	1	2	700	4,735,252
400	4	3	4	1,600	4,520,146
450	1	1	1	450	4,310,040
500	11	7	11	5,500	4,104,933
700	2	1	2	1,400	3,334,508
800	1	1	1	800	2,979,295
900	1	1	1	900	2,644,082
950	1	1	1	950	2,483,976
1,000	6	4	6	6,000	2,328,870
1,200	2	1	2	2,400	1,758,444
1,250	1	1	1	1,250	1,628,338
1,500	4	3	4	6,000	1,052,806
1,600	1	1	1	1,600	857,594
1,750	1	1	1	1,750	602,275
1,800	3	2	3	5,400	527,168
2,000	10	7	10	20,000	276,743
2,300	1	1	1	2,300	51,105
2,400	1	1	1	2,400	15,892
2,450	1	1	1	2,450	5,786
2,500	8	5	8	20,000	679
3,000	7	5	7	21,000	224,616
3,433	1	1	1	3,433	822,534
3,500	3	2	3	10,500	948,552
3,600	1	1	1	3,600	1,153,340
4,000	1	1	1	4,000	2,172,489
4,333	1	1	1	4,333	3,266,224
5,000	9	6	9	45,000	6,120,362
5,333	1	1	1	5,333	7,880,764
5,500	1	1	1	5,500	8,844,298
6,000	2	1	2	12,000	12,068,235
6,470	1	1	1	6,470	15,554,635
6,500	1	1	1	6,500	15,792,171
7,000	3	2	3	21,000	20,016,108
7,250	1	1	1	7,250	22,315,576
7,500	1	1	1	7,500	24,740,044
8,000	2	1	2	16,000	29,963,981
Total	**105**	**68**	**100**	**265,237**	**220,622,401**
Missing	50	32			
Total	155	100	Mean	2,526	
			SD	1,450	
			Mode	2,000	

			Median	2,000	

Table 7: Household's expenditure on Electricity

What is the household's monthly expenditure on Electricity					
Rent in Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
100	6	4	4	600	68,037
150	1	1	1	150	44,453
200	34	22	24	6,800	25,869
250	17	11	12	4,250	12,285
300	42	27	29	12,600	3,701
350	2	1	1	700	117
400	10	7	7	4,000	1,534
500	17	11	12	8,500	19,366
600	3	2	2	1,800	57,198
700	3	2	2	2,100	115,030
800	2	1	1	1,600	192,862
1,000	4	3	3	4,000	408,527
1,500	1	1	1	1,500	1,297,687
3,000	1	1	1	3,000	6,965,170
Total	143	92	100	51,600	9,211,837
Missing	12	8			
Total	155	100	Mean	361	
			SD	254	
			Mode	300	
			Median	300	

Table 8: Household's expenditure on Transport

What is the household's monthly expenditure on transport					
Ksh (x)	**No of respondents(f)**	**Percent**	**Valid Percent**	**Total (x*f)**	**(x-x)^2**
200	1	1	2	200	4,088,361
250	1	1	2	250	3,888,664
300	2	1	3	600	3,693,968
500	6	4	9	3,000	2,965,180
600	3	2	5	1,800	2,630,786
650	1	1	2	650	2,471,089
700	3	2	5	2,100	2,316,392
750	1	1	2	750	2,166,695
800	1	1	2	800	2,021,998
1,000	3	2	5	3,000	1,493,210
1,200	7	5	11	8,400	1,044,422
1,500	3	2	5	4,500	521,240
1,800	3	2	5	5,400	178,058
2,000	5	3	8	10,000	49,271
2,500	2	1	3	5,000	77,301
2,700	1	1	2	2,700	228,513
3,000	12	8	18	36,000	605,331
3,500	1	1	2	3,500	1,633,361
4,000	2	1	3	8,000	3,161,392
4,500	2	1	3	9,000	5,189,422
5,000	1	1	2	5,000	7,717,452
6,000	3	2	5	18,000	14,273,513
8,000	1	1	2	8,000	33,385,634
10,000	1	1	2	10,000	60,497,755
Total	66	43	100	146,650	156,299,008
Missing	89	57			
Total	155	100	Mean	2,222	
			SD	1,539	
			Mode	3,000	
			Median	300	

Table 9: Household's expenditure on others

What is the household's monthly expenditure on others....					
Rent in Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
100	2	1	6	200	2,288,991
120	2	1	6	240	2,228,873
150	1	1	3	150	2,140,197
200	1	1	3	200	1,996,403
350	1	1	3	350	1,595,020
500	4	3	12	2,000	1,238,638
800	1	1	3	800	660,873
900	1	1	3	900	508,285
1,000	6	4	18	6,000	375,697
1,500	2	1	6	3,000	12,756
2,000	5	3	15	10,000	149,815
2,500	1	1	3	2,500	786,873
3,000	2	1	6	6,000	1,923,932
4,000	2	1	6	8,000	5,698,050
4,500	1	1	3	4,500	8,335,109
5,000	2	1	6	10,000	11,472,167
Total	34	22	100	54,840	41,411,680
Missing	121	78			
Total	155	100	Mean	1,613	
			SD	1,104	
			Mode	1,000	
			Median	1,000	

Table 10: Household's expenditure on savings

How much is allocated for saving each month?					
Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
100	2	1	3	200	3,242,572
200	3	2	4	600	2,892,429
250	1	1	1	250	2,724,858
300	2	1	3	600	2,562,286
500	9	6	13	4,500	1,962,001
600	2	1	3	1,200	1,691,858
800	2	1	3	1,600	1,211,572
900	2	1	3	1,800	1,001,429
1,000	7	5	10	7,000	811,286
1,200	1	1	1	1,200	491,001
1,500	13	8	19	19,500	160,572
2,000	9	6	13	18,000	9,858
3,000	5	3	7	15,000	1,208,429
3,600	1	1	1	3,600	2,887,572
4,000	1	1	1	4,000	4,407,001
4,500	2	1	3	9,000	6,756,286
5,000	6	4	9	30,000	9,605,572
7,000	1	1	1	7,000	26,002,715
8,000	1	1	1	8,000	37,201,286
Total	70	45	100	133,050	106,830,581
Missing	85	55			
Total	155	100	Mean	1,901	
			SD	1,235	
			Mode	1,500	
			Median	1,500	

Table 11: Household's total expenditure

Total expenditure					
Ksh (x)	**No of respondents(f)**	**Percent**	**Valid Percent**	**Total (x*f)**	**(x-x)^2**
1,450	1	1	1	1,450	119,851,170
2,050	1	1	1	2,050	107,073,983
3,000	2	1	1	6,000	88,315,937
3,100	1	1	1	3,100	86,446,405
3,200	1	1	1	3,200	84,596,874
3,660	1	1	1	3,660	76,346,631
3,850	1	1	1	3,850	73,062,422
3,900	1	1	1	3,900	72,210,156
3,950	1	1	1	3,950	71,362,890
4,200	1	1	1	4,200	67,201,562
4,800	3	2	2	14,400	57,724,375
4,900	1	1	1	4,900	56,214,844
5,000	2	1	1	10,000	54,725,313
5,200	1	1	1	5,200	51,806,251
5,220	1	1	1	5,220	51,518,744
5,300	1	1	1	5,300	50,376,719
5,350	2	1	1	10,700	49,669,454
5,400	1	1	1	5,400	48,967,188
5,470	1	1	1	5,470	47,992,416
5,950	3	2	2	17,850	41,572,267
6,000	1	1	1	6,000	40,930,001
6,050	1	1	1	6,050	40,292,736
6,100	1	1	1	6,100	39,660,470
6,200	1	1	1	6,200	38,410,939
6,250	2	1	1	12,500	37,793,673
6,300	1	1	1	6,300	37,181,408
6,600	1	1	1	6,600	33,612,814
6,650	1	1	1	6,650	33,035,549
6,700	3	2	2	20,100	32,463,283
6,800	1	1	1	6,800	31,333,752
7,150	2	1	1	14,300	27,537,893
7,250	1	1	1	7,250	26,498,361
7,500	1	1	1	7,500	23,987,033
7,550	1	1	1	7,550	23,499,768

Total expenditure- Cont.					
Ksh (x)	**No of respondents(f)**	**Percent**	**Valid Percent**	**Total (x*f)**	**(x-x)^2**
7,600	2	1	1	15,200	23,017,502
7,660	1	1	1	7,660	22,445,384
7,690	1	1	1	7,690	22,162,024
7,750	2	1	1	15,500	21,600,705
7,800	1	1	1	7,800	21,138,440
8,150	1	1	1	8,150	18,042,581
8,200	1	1	1	8,200	17,620,315
8,250	1	1	1	8,250	17,203,050
8,350	1	1	1	8,350	16,383,518
8,400	1	1	1	8,400	15,981,253
8,500	1	1	1	8,500	15,191,722
8,620	1	1	1	8,620	14,270,684
8,650	1	1	1	8,650	14,044,925
9,050	2	1	1	18,100	11,206,800
9,100	3	2	2	27,300	10,874,535
9,250	3	2	2	27,750	9,907,738
9,600	1	1	1	9,600	7,826,879
9,900	1	1	1	9,900	6,238,285
10,050	1	1	1	10,050	5,511,488
10,150	2	1	1	20,300	5,051,957
10,300	2	1	1	20,600	4,400,160
10,400	1	1	1	10,400	3,990,629
10,450	1	1	1	10,450	3,793,364
10,530	1	1	1	10,530	3,488,139
10,550	1	1	1	10,550	3,413,832
10,650	1	1	1	10,650	3,054,301
10,900	1	1	1	10,900	2,242,973
11,000	1	1	1	11,000	1,953,442
11,200	1	1	1	11,200	1,434,380
11,350	1	1	1	11,350	1,097,583
11,400	2	1	1	22,800	995,317
11,500	2	1	1	23,000	805,786

Total expenditure –Cont.

Ksh (x)	No of respondents(f)	Percent	Valid Percent	Total (x*f)	(x-x)^2
11,667	1	1	1	11,667	533,858
11,800	1	1	1	11,800	357,193
11,900	1	1	1	11,900	247,661
11,950	1	1	1	11,950	200,396
12,050	1	1	1	12,050	120,865
12,100	1	1	1	12,100	88,599
12,300	1	1	1	12,300	9,537
12,320	1	1	1	12,320	6,030
12,450	1	1	1	12,450	2,740
12,500	2	1	1	25,000	10,474
13,050	1	1	1	13,050	425,553
13,300	1	1	1	13,300	814,225
13,520	1	1	1	13,520	1,259,656
13,550	1	1	1	13,550	1,327,897
13,650	1	1	1	13,650	1,568,366
13,750	1	1	1	13,750	1,828,835
13,800	1	1	1	13,800	1,966,569
13,900	1	1	1	13,900	2,257,038
14,000	1	1	1	14,000	2,567,507
14,393	1	1	1	14,393	3,981,398
14,450	1	1	1	14,450	4,212,116
14,500	1	1	1	14,500	4,419,851
14,600	1	1	1	14,600	4,850,319
14,700	2	1	1	29,400	5,300,788
14,950	1	1	1	14,950	6,514,460
15,100	1	1	1	15,100	7,302,664
15,500	1	1	1	15,500	9,624,539
15,800	1	1	1	15,800	11,575,945
17,100	1	1	1	17,100	22,112,040
17,150	1	1	1	17,150	22,584,774
17,300	1	1	1	17,300	24,032,978
17,400	1	1	1	17,400	25,023,446
17,850	1	1	1	17,850	29,728,056

17,900	1	1	1	17,900	30,275,790

Total expenditure –Cont.					
Ksh (x)	**No of respondents(f)**	**Percent**	**Valid Percent**	**Total (x*f)**	**(x-x)^2**
18,100	2	1	1	36,200	32,516,728
18,750	1	1	1	18,750	40,352,275
19,000	2	1	1	38,000	43,590,947
19,200	1	1	1	19,200	46,271,885
19,400	1	1	1	19,400	49,032,823
19,650	1	1	1	19,650	52,596,495
20,200	1	1	1	20,200	60,876,573
21,300	1	1	1	21,300	79,251,730
21,600	1	1	1	21,600	84,683,137
21,800	1	1	1	21,800	88,404,074
21,900	1	1	1	21,900	90,294,543
22,100	1	1	1	22,100	94,135,481
22,120	1	1	1	22,120	94,523,975
22,300	1	1	1	22,300	98,056,418
22,500	1	1	1	22,500	102,057,356
22,600	1	1	1	22,600	104,087,825
24,400	1	1	1	24,400	144,056,264
24,600	1	1	1	24,600	148,897,201
25,000	1	1	1	25,000	158,819,076
25,433	1	1	1	25,433	169,928,886
25,500	1	1	1	25,500	171,671,421
27,500	1	1	1	27,500	228,080,797
28,000	1	1	1	28,000	243,433,141
28,700	1	1	1	28,700	265,766,423
29,200	1	1	1	29,200	282,318,767
29,800	1	1	1	29,800	302,841,580
30,500	1	1	1	30,500	327,694,861
37,933	1	1	1	37,933	652,070,821
58,900	1	1	1	58,900	2,162,468,005
Total	**155**	**100**	**100**	**1,921,637**	**8,795,574,644**
			Mean	12,398	
			SD	7,533	
			Mode	9,250	

Median	10,530