DOMESTIC SOLID WASTE MANAGEMENT IN GITOTHUA WARD OF RUIRU, KIAMBU COUNTY

PRISCILLA GATHIGIA NJOGU

MASTER OF SCIENCE

(Public Health)

JOMO KENYATTA UNIVERSITY OF

AGRICULTURE AND TECHNOLOGY

2018

Domestic Solid Waste Management in Gitothua Ward of Ruiru, Kiambu County

Priscilla Gathigia Njogu

A Thesis Submitted in Partial Fulfillment for the Degree of Master of Science in Public Health in the Jomo Kenyatta University of Agriculture and Technology

2018

DECLARATION

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

Signature..... Date.....

Priscilla Gathigia Njogu

This thesis has been submitted for examination with our approval as University supervisors.

Signature..... Date.....

Dr. Charles F.L. Mbakaya, PhD

KEMRI, Kenya

Signature..... Date.....

Prof. Ciira Kiiyukia, PhD

JKUAT, Kenya

DEDICATION

This thesis is dedicated to my lovely husband James and my children Herman, Teresa and Esther for the support and love they gave me as I undertook this project.

ACKNOWLEDGEMENT

The completion of this study has been made possible through indispensable assistance and encouragement of a number of people. However, it may be difficult to mention all of them but I have to mention a few.

Most importantly, I thank the Almighty God for granting me the opportunity and strength to successfully complete this project. Glory be to Him.

Secondly, I am sincerely grateful to my entire family which allowed me to deny them my time and focus on this study. They always encouraged me whenever I felt like giving up. You are great people, a loving family at all times.

In addition, I wish to acknowledge and thank my supervisors Dr. Charles F.L Mbakaya and Prof. Ciira Kiiyukia for their encouragement and guidance at every stage. Your dedication and valuable suggestions have enabled me to complete this project successfuly.

Last but not least, I thank all those who voluntarily participated in giving the necessary information and data for utilization in the project. God bless you at his right time.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

LIST OF ABREVIATION AND ACRONYMS

ERC…….. Ethical research committee

EPA…….Environmental Protective Agency

EMCA…….Environmental Management and Co- Ordination Act

CI…….. Confidence interval

DEAT…… Department of Environmental Affairs and tourism

ISWM……Integrated solid Waste Management

KEMRI…… Kenya medical research institute

MDG(s)……Millennium Development Goals

NWMSP…… National waste Management Strategy Action plans

NEMA……National Environment Management Agency

PVCs…….. 'Polyvinyl chloride(s)

'**SSC……**Scientific steering committee

VOC……. Volatile Organic Compounds

W.H.O.....World Health Organisation

W.T.E…….Waste to energy

ABSTRACT

Solid waste management may be defined as that displine associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner that is friendly to the envionment and human health. In Gitothua residential area poor solid waste management is significant where heaps of solid wastes are seen in open space, outside houses and in open drainage. This leads to breeding sites of insects and other vermin which can eventually lead to outbreak of communicable diseases. The Gitothua ward is divided into five villages namely; Gitothua, Membley, Mukuyu, Tatu and BTL. The approximate population of Gitothua is 18,083 with an approximately 5006 households. Some wards in Ruiru, Gitothua being one of them do not receive services from the county government regularly leading to accumulation of wastes in the open spaces. The main objective of the study was to examine the management of domestic solid waste in the Gitothua ward. The study design used was cross sectional study with a sample size of 370. Sampling technique used was systematic sampling where a list of household was obtained with the assistance of sub county statistical officer, Thika. The study subjects were the adults in the households who were willing to participate in the research. The data was collected by a structured questionnaire and observations. The data was analysed using statistical package for social scientists (SPSS) and then presented using tables, pie charts and graphs. Photographs were taken where necessary during data collection. The study findings indicated the main types of solid waste generated in Gitothua were food remains, plastic and polythene papers wastes. Most of the respondents (62%) were not separating the waste, 50% of the respondent indicated that their waste was never collected while only 35% used county services for collection of their waste. 55% of the respondents are used to dumping their waste in the open spaces as a means of disposal. According to the results, 76% were not aware of reduce, reuse and recycle principal of solid waste management. 75% knew the meaning of solid waste while 86% of them were aware of the negative impact of poor solid waste management. The results indicated that age and family size were factors associated with solid waste

management practices. While family size of three people was compliant to solid waste management compared to a lesser family size (p=0.000). Frequency of solid waste collection by the county government was irregular in the whole study area where in some areas collecton is done weekly and others is not collected at all. The results showed the laxicity of the county goverment in providing services such us provision of dust bin, irregular garbage collection and few garbage collection vehicles as the factors associated with poor domestic sold waste management in the study area.The county goverment should conduct seminars in Gitothua to educate residents on proper solid waste management. Provision of standard storage receptacles and addation of transportation vehicles is recommended.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the Environment (EMCA, 1999). Public Health Act Cap 242 Laws of Kenya 116. Local authorities to maintain cleanliness and preventnuisances. It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for maintaining its county at all times in clean and sanitary condition, and for preventing the occurrence therein of, or for remedying or causing to be remedied, any nuisance or condition liable to be injurious or dangerous to health, and to take proceedings at law against any person causing or responsible for the continuance of any such nuisance or condition.

EMCA 1999 Laws of Kenya, 87.(1) No person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such manner as to cause pollution to the environment or ill health to any person.

Increasing urbanization, rural urban migration and population growth have resulted in increased solid waste generation. This increase has not been accompanied with equivalent capacity to handle the waste generated. Solid waste generated includes, plastics, glass, ceramics , metal, leather, wood, textiles, paper and domestic organic waste (food waste).

In Kenya, the challenge of Solid Waste Management is real (Gakungu, 2011). Collection systems are inefficient and disposal systems are not environmentally friendly. 30 to 40 per cent of all solid waste generated in urban areas is uncollected and less than 50 per cent of the population is served (Otieno, 2011). He states that up to 80 per cent of collection transport is out of service or in need of repair and argues that if the issue of sustainable solid waste management in Kenya is not considered urgently, all the towns in Kenya will be engulfed in waste. These domestic solid

waste is any non putrescible waste consisting of combustible materials which come from household, arising from human activities and has no value to people who possess it. (Kaseve *et al*, 2005). In the early days, waste disposal was not a problem as habitations were sparse and land was plentiful. Waste disposal became a problem with the rise of towns and cities where large numbers of people started to congregate in relatively small areas in pursuit of livelihoods (Shafiu *et al.*, 2003). In 2014, National Environment Management Authority, Kenya (NEMA) came up with the The National Solid Waste Management Strategy. The purpose of this Strategy is to guide sustainable solid waste management in Kenya to ensure a healthy, safe and secure environment for all. The Strategy is a deliberate and visionary commitment for the country in the management of solid waste.

Waste generation rates are dependent on several factors. The basic factor is population, which is the number of people generating the waste in the area in question. The greater the number of people generating the waste, the greater the rate of waste generation. However, waste generation rates are dependent on other factors. Ngoc and Schnitzer (2009) argue that waste generation rates are affected by socio-economic development, degree of industrialization and climate. This argument is true for public places like municipalities but for technical training institutions, the waste generation rate is dependent on factors like the institution type. Domestic waste is also referred to as garbage, refuse or trash. It consists mainly of biodegradable waste which is food and kitchen waste, green waste paper and nonbiodegradable such as plastics, glass bottles, cans, metals and wrapping materials. The composition of the domestic waste streams is a function of income, consumption patterns and recycling opportunities. Nationally domestic waste is not adequately managed and is disposed off at our disposal sites with minimal sorting/segregation. While the population densities in urbanised areas and per capital waste generation increased, the available land for waste disposal decreased proportionately. Solid waste management thus emerged as an essential, specialised sector for keeping cities healthy and lively. Poor domestic solid waste management is not an individual country's problem but rather it is increasingly becoming a big

problem in many cities of the world (El fidel *et al.,* 2006). For instance, according to State of the Environment Report for South Africa, the country generates over 42 million cubic meters of domestic waste every year. This is about 0.7 kg solid waste per person per day, which is more typical of developed countries than a developing country (by comparison the figure in the UK is 0.73 kg, 0.87 kg in Singapore and 0.3 kg in Nepal). In addition, 5 million cubic meters of hazardous waste is generated every year (Fauzia *et al.*, 2009).

According to study done in East African urban towns, residential areas or households are the major contributors of solid waste but the collection and disposal by the county government is not effective (Kaseve *et al.*, 2005). The Kenya Vision 2030 recognizes the need for efficient and sustainable waste management systems to be established as the country develops into a newly industrialized state by 2030. In this regard the Vision 2030 identified solid waste management for five cities and towns namely; Mombasa, Kisumu, Eldoret, Nakuru and Thika as one of the flagship projects.

Domestic solid waste management practices refers to source separation, storage, collection, reuse, reduce, recycling, transportation and final disposal in an environmentally sustainable manner. Diseases such as cholera, typhoid, plague, dysentery and malaria are all related to the practice of poor solid waste management. This can result to the loss of human resources needed in the development of the country (Lacoste *et al.*, 2007). A study done in the city of Surat in the state of Gujarat showed that the out break of pneumonic plague was due to county government failure to dispose off garbage from the households (Priya & Kuma, 2003)

The collection, transfer and disposal of waste have been the role of governments in both developed and developing countries. This constitutes a major government undertaking given the comprexicity of the solid waste generated by numerous economic activities. The format of collection varies whereby in most urban areas domestic solid waste is collected either by a government agency or private contractor licenced by the government. Despite the fact that developing countries spend about

20 to 40 per cent of their revenues on waste management, they are still unable to keep up with the scope of the problem **(**Zerbock, 2003).

A study done in Nima,Ghana showed that contributary factor to poor domestic solid waste management is lack of enforcement of existing by-laws. (Fredual, 2007). When the governments of African countries were required by the World Health Organization (WHO) to prioritize their environmental health concerns, the it was obvious that domestic solidwaste management was the second most important problem after water quality (Senkoro *et al.,* 2004). In Kenya like in many other developing countries, one to two thirds of the waste generated is not collected. As a result, the uncollected waste, which is often mixed with human and animal excreta is dumped indiscriminately in the streets and in drains. This leads to blockage of the drainage leading to formation of stagnant polluted water which become the breeding ground of mosquitos. The uncollected solid waste also encourages breeding of rodents and other pests some of which are vectors of human pathogens. A study done in Nairobi found that there heaps of uncollected garbage in residential areas and city centre which is an eyesore. This is as a result of the failure to enforce environmental legislations (Ikiala, 2004). A research done in Thika (UNEP, 2009) on solid waste management revealed that domestic solid waste was a challenge despite spending huge amounts of revenue in its management. A study done in Nakuru revealed the willingness of the urban communities to participate in domestic solid waste management to complement the services of municipal authorities although there was no community sensitization programmes. Poor domestic waste management in Ruiru is evident where some wards do not receive services leading to poor waste disposal which has negative effect to human health and environment, (Oberlin , 2011)

1.2 Statement of the problem

Poor domestic solid waste management has potential of serious impacts on environment and on human health. It can lead to surface water contamination, land pollution and air quality deterioration (Ruiz, 2001) Water infiltration through the heaps of solid wastes can lead to ground water contamination. Dust and litter scattered by

wind are responsible for deterioration of air quality in the vicinity of disposal sites. Uncollected garbage produces odour and affects the aesthetic of the area. Decomposition of organic waste releases abnoxious gases (H_2S, CH_4, NH_3) which is a threat to human health and a threat to grobal warming **(**Priya & Kuma, 2003).

Gitothua is a fast developing residential locality within Ruiru sub-county of Kiambu county. In Gitothua, heaps of household waste are seen spread on bacyards of every reidential units. The garbage includes the food waste, plastics, metalic, fabric (textile), porcelline and glass. Uncollected garbage end up into open drainage system thus causing surface water blockages during the rainy seasons. Accumulation of uncollected garbage in Gitothua can be a good bleeding ground of flies, mosquitoes, rats and other insects and animals of public health importance. This has the potential of causing communicable diseases outbreak such as cholera, plague, typhoid, malaria and the respiratory diseases due to polluted air.

1.3 Objectives

1.3.1 Broad objective

Domestic solid waste management in Gitothua ward of Ruiru, Kiambu county.

1.3.2 Specific objectives

1. To determine the types of domestic solid waste generated in Gitothua ward of Kiambu county.
2. To establish practices of domestic solid waste management in Gitothua ward of Kiambu county.
3. To determine the factors associated with domestic solid waste management in Gitothua ward of Kiambu county

1.4 Research Questions

1. What are the types of domestic solid waste generated in gitothua ward of Ruiru, Kiambu county
2. What are the domestic solid waste management practices in Gitothua ward of Ruiru , Kiambu county ?
3. What are the limitations associated with practicing sound domestic waste management in Gitothua?

1.5 Justification of the study

Solid domestic waste management has been identified as one of the most serious urban neighborhood threats to public health in sub-Saharan Africa. The pertinent question to ask is whether this is a structural or behavioral problem or both. The rapid development of residential houses in the Gitothua ward is one of the contributory factors of increased domestic waste. The problem is compounded by seemingly ineffective county garbage collection services. Buildings are constructed without proper planning and consideration of the consequences of the increased population. This has led to indiscriminate dumping of domestic solid waste in any vacant land in and around the Gitothua Ward. The Sub-county government of Ruiru provides collection of domestic waste in some wards but the service is not regular. This has lead to accumulated solid waste in the wards thus leading to negative environmental and aesthetic consequences. The study will erabolate on the potential of the outbreak of diseases related to poor solid waste management and expose the associated weaknesses thereof. Additionally, the study will contribute to existing body of knowledge on urban solid waste management and also stimulate further studies on the subject in other urban settlements.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Events of the early century to date indicate that waste in whatever form or classification- solid, liquid or gasious have become a major consequence of modernization and economic development (Tsiboe, 2004).

2.2 Solid waste

Any form of waste that is less than 70% water is classified as solid waste. Household solid waste contains not only valuable and reusable materials such as metals, glass, paper, plastic and food remains but also contains hazardous waste such as mercury from batteries, continuum from fluorescent tubes and toxic chemicals from disinfectants (Kharbanda & Williams 2001). Solid waste is generated from domestic, commercial, industrial, health care, agriculture and mineral extraction. Therefore solid waste is any material which comes from domestic, commercial and industrial sources arising from human activities which has no value to people who possess it and is discarded as useless (Zhu *et al.*, 2008).

2.3 Sources and Types of Solid Waste

On daily bases tons of solid waste is disposed of at various landfill sites. This solid waste comes from homes, offices, industries and various other agricultural related activities. These landfill sites produce foul smell if waste is not stored and treated properly. It can pollute the surrounding air and can seriously affect the health of humans, wildlife and our environment. The following are major sources of solid waste:

2.3.1 Residential

Residences and homes where people live are some of the major sources of waste generally called domestic solid waste. Garbage from these places include food wastes,

plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes and special wastes like bulky household items like electronics, tires, batteries, old mattresses and used clothes. Most homes have garbage bins where they can throw away their solid wastes in and later the bin is emptied by a garbage collecting firm or municipality for treatment. A great portion of solid waste of the residential sources can decompose quickly especially in warm weather (Zurbrugg, 2009).

2.3.2 Industrial

Industries are known to be one of the biggest contributors of solid waste. They include light and heavy manufacturing industries, construction sites, fabrication plants, canning plants, power and chemical plants. These industries produce solid waste in form of housekeeping wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes as well as other hazardous wastes.

2.3.3 Commercial

Commercial facilities and buildings are yet another source of solid waste today. Commercial buildings and facilities in this case refer to hotels, markets, restaurants, go downs, stores and office buildings. Some of the solid wastes generated from these places include plastics, food wastes, metals, paper, glass, wood, cardboard materials, special wastes and other hazardous wastes. Priya et al. (2003).

2.3.4 Institutional

The institutional centers like schools, colleges, prisons, military barracks and other government centers also produce solid waste. Some of the common solid wastes obtained from these places include glass, rubber waste, plastics, food wastes, wood, paper, metals, cardboard materials, electronics as well as various hazardous wastes.

2.3.5 Construction and Demolition Areas

Construction sites and demolition sites also contribute to the solid waste problem. Construction sites include new construction sites for buildings and roads, road repair sites, building renovation sites and building demolition sites. Some of the solid wastes produced in these places include steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass.

2.3.6 County services

The urban centers also contribute immensely to the solid waste crisis in most countries today. Some of the solid waste brought about by the county services include, street cleaning, wastes from parks and beaches, wastewater treatment plants, landscaping wastes and wastes from recreational areas including sludge.

2.3.7 Treatment Plants and Sites

Heavy and light manufacturing plants also produce solid waste. They include refineries, power plants, processing plants, mineral extraction plants and chemicals plants. Among the wastes produced by these plants include, industrial process wastes, unwanted specification products, plastics, metal parts just to mention but a few (Ruiz, 2001).

2.3.8 Agriculture

Crop farms, orchards, dairies, vineyards and feedlots are also sources of solid wastes. Among the wastes they produce include agricultural wastes, spoiled food, pesticide containers and other hazardous materials.

2.3.9 Biomedical

This refers to hospitals and biomedical equipment and chemical manufacturing firms. In hospitals there are different types of solid wastes produced. Some of these solid wastes include syringes, bandages, used gloves, drugs, paper, plastics, food wastes and chemicals. All these require proper disposal or else they will cause a huge problem to the environment and the people in these facilities. (Banga, 2004).

2.4 Solid Waste Management

Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for recycling items that do not belong to garbage or trash. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue. Waste management is all about how solid waste can be changed and used as a valuable resource. Solid waste management should be embraced by each and every household including the business owners across the world. Industrialization has brought a lot of good things and bad things as well. One of the negative effects of industrialization is the creation of solid waste.

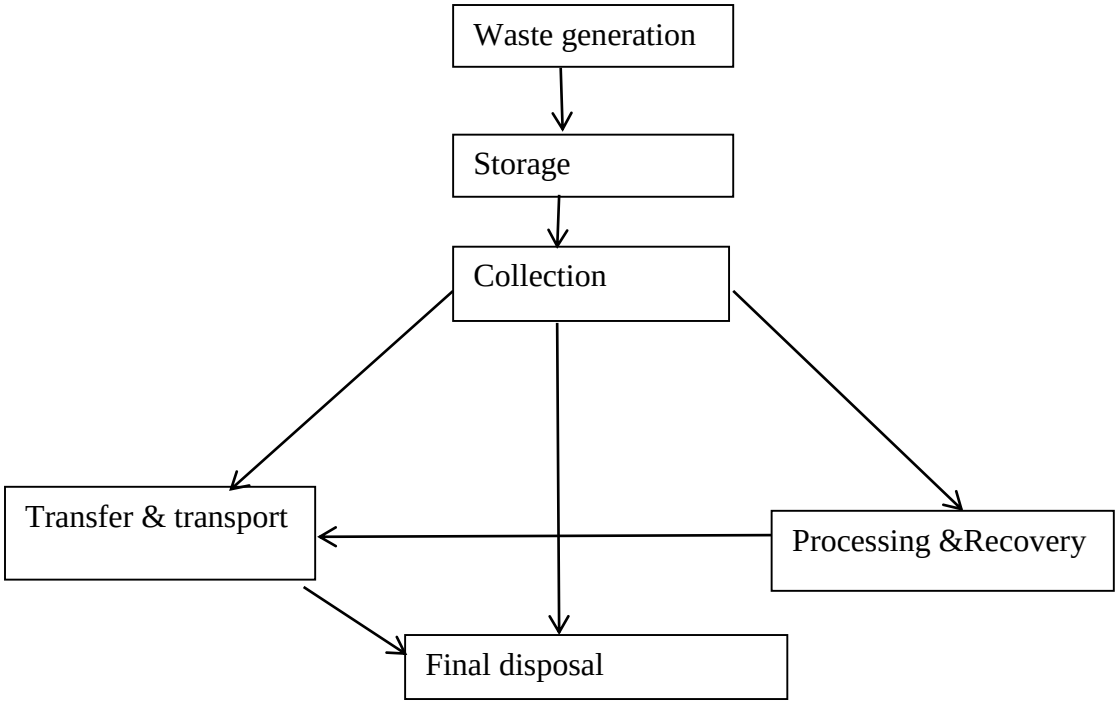

Figure2.1: Elements of solid waste management process (Unep, 2009)

Solid waste management may be defined as that displine associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner that is friendly to the envionment and human health (Fauzia *et al.*, 2009).

2.4.1 Waste Generation and Separation

Huge quantities of domestic solid waste are generated in all the megacities of the world. The volume of solid waste generated varies with the lifestyle of the people. Globally, the total amount of waste generation reached 2.2 billion cubic metres and this is estimated to rise by 37.3 percent in 2025 due to rapid increase of population (Lacoste & Judith, 2007). In Kenya 61% of the waste generated in urban centres emanates from residential areas out of which only 40% is disposed in designated disposal sites (Omran *et al.*, 2009).

Separation of domestic solid waste is preferable at source. This simplifies the management of the solid waste to be disposed. Bags and containers for storing waste may be identified through coding as shown below (Iqbal *et al.*, 2001).

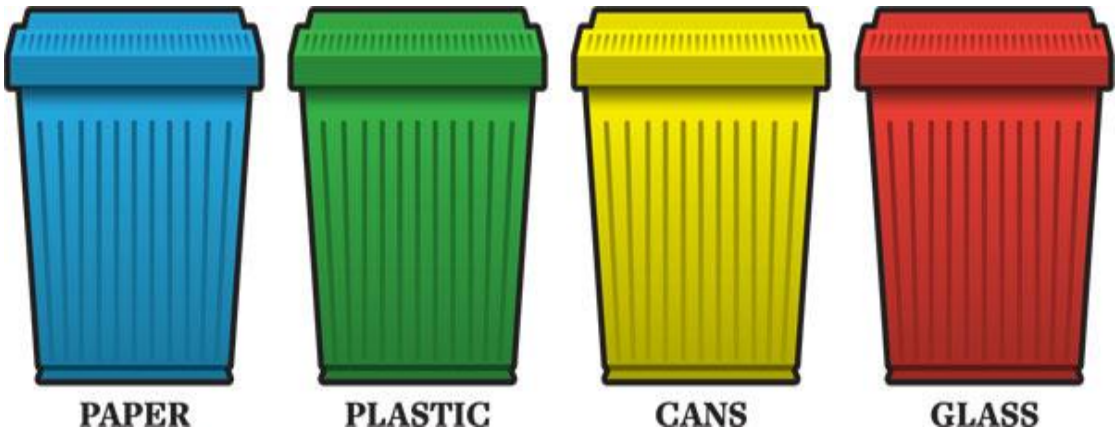

Figure 2.2: Examples of coded dustbins

2.4.2 Composition of Solid Waste

The composition of domestic solid wastes is the term that describes the distribution of each component of wastes, suitable treatment and disposal methods, (UNEP, 2009). Domestic solid waste commonly known as trash or garbage consists of everyday item that we use and throw away such as packaging materials, furniture clothing, bottles, food scraps newspapers and batteries. These comes from activities in our homes. The quantity and composition of domestic waste depends on how developed the community is and the state economy. Industrial growth raises the per capita income of the population and thus generating more waste (EPA, 2007). If the domestic solid waste is not properly managed, it causes environmental degradation and this in turn affects the well being of the population (Omran *et al.*, 2009).

2.4.3 Storage of Domestic waste

Storage of waste at source is the first essential step of Solid Waste management. Every household generates solid waste on daily basis. The waste should normally be stored at the source of generation till collected for disposal. If citizens keep on throwing waste on streets, the urban area will never be clean (Ikiala, 2004).

Generally very few people keep personal bins. The disposal of waste in the streets clog drains and pollutes water resources in urban areas. Buckets, plastic bags, plastic bins and metals bin with or without lid are used in storing wastes. A study done in Kerala by UNEP found that dustbins without lid containing food remains stink very bad and can harbour insects and other vermin (Hester & Harrison, 2002). To keep streets and public places clean throughout the day, it is necessary to educate people to store their waste at source with personal bins and dispose it to the municipal system only at specified time (UNEP, 2009).

2.4.4 Waste Collection

In developing countries, collection often involves a face to face transaction between generator and collector (Morrissey & Brown, 2004). In most cities in developing countries, there are many areas that receive no collection services. Collection of domestic solid waste may miss large areas of poor squarter settlements, areas that are hilly, neighbourhoods with unpaved or impassable streets or areas where houses are too close for vehicles to get through (Chris Zurberg & Viragha, 2007). A study done in urban cities of Kenya (Nairobi, Thika and Nakuru) showed that there was shortage of collection vehicles and recommended that a town with a population more than 100,000 people requires about 7 ton trucks for daily transport of domestic wastes (Sira & Christina, 2004). Frequency of collection is influenced by characteristics of waste, climate, type of storage and degree of involvement by members of households. Collection of solid wastes is the most costly part of waste management and a proper collection system design can reduce the cost significantly. Frequency of collection is based on the cost as well as climate of the locality. In hot and humid climates, solid

waste must be collected twice per week (UNEP, 2009). Appropriate storage containers are required to save the energy and labor and increase the speed of collection. Containers should also be durable, easy to handle as well as resistant to corrosion. The most commonly used is a dump truck fitted with a hydraulic lifting mechanism. In places where large vehicles are used, the collection crews and the drivers work as a team (Beukerung *et al.*, 2001).

2.4.5 Transfer and Transport

According to Kaseve *et al.* (2005) transfer and involves the transfer of smaller collection vehicles to the larger transport equipment and subsequent ransport of waste usually over long distances to final disposal site. Although motor vehicle transport is the most common, transport by whellballows and hardcarts is also availlable (Mangizuo, 2008).

2.4.6 Processing and Recovery

The element of processing and recovery includes all the technology, equipments and facilities used to improve the efficiency of other functional element and to recover usable materials. In the recovery, separations operations have been devised resources from the solid waste delivered to the transfer stations or solid waset processing plants (Tsiboe, 2004)

2.5 Methods of Solid Waste Management

There are different methods of solid waste management. The following are some of the recognized methods:

2.5.1 Sanitary Landfill

This is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam. Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner which is usually made of several layers of thick plastic and sand. This

liner protects the ground water from being contaminated because of leaching or percolation. When the landfill is full, it is covered with layers of sand, clay, top soil and gravel to prevent seepage of water.

2.5.2 Recovery and Recycling

Recycling or recovery of resources is the process of taking useful but discarded items for next use. Traditionally, these items are processed and cleaned before they are recycled. The process aims at reducing energy loss, consumption of new material and reduction of landfills.

2.5.3 Composting

Due to lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose. Only biodegradable waste materials are used in composting. Good quality environmentally friendly manure is formed from the compost and can be used for agricultural purposes (Ongunya, 2014).

2.5.4 Pyrolysis

This is method of solid waste management whereby solid wastes are chemically decomposed by heat without presence of oxygen. This usually occurs under pressure and at temperatures of up to 430 degrees Celsius. The solid wastes are changed into gasses, solid residue and small quantities of liquid. Proper solid waste management is an integral part of environmental conservation that should be observed by individuals and companies globally. This will keep the environment clean and reduce health and settlement problems (Ngoc *et al.*, 2009).

Disposal is the final stage in the domestic solid waste management. All the wastes are collected and transported to a disposal site. It may be a landfill site or an incinerator and other mode of disposal (Beukerung *et al.*, 2001). In the developing countries, solid waste are disposed along the roads in cities and towns . This gives rise to several problems like water pollution and blockage of sewer lines. An efficient waste

management system is the one that provides ecologically sound disposal option for waste that can not be reduced recycled, composited , combusted or processed further, (Alkatib & Ali, 2001).

Open dumping is the common method used in developing countries. In this method the solid waste collected from the town is deposited in low lying areas usually on the outskirts of the town. The open dumps are left uncovered and they attract flies, birds, insects and rodents leading to public health nuisances. According to a study done in Kampala by Oberlin, 2011, open dumping was found to be the most common method used in solid waste. Another frequently used waste disposal method in developing countries is waste burying on land. Waste is buried underground where it is left to decompose naturally. This method has advantages on organic waste by reducing odours and discouraging breeding of insects and other vermins (Kharbanda & Williams 2001).

Burning of solid waste is still practiced in developing countries. A research done in Ado-Akit in Nigeria by Momoh and Oladebeye, (2010) showed that burning of waste was done at the backyard of the houses and in open dumpsites. The main justification of waste burning is to reduce the volume of wastes. Such practices are discouraged because they pollute land, air and pose threats to human health. Sanitary landfill is a waste disposal method on land which involves planning and application of sound engineering principles and construction techniques (Peterson & Hamada, 2006). Sanitary landfills work by layering waste and soil in a large hole in the ground that is lined with plastic and clay. The waste is allowed to decompose and the linings help prevent contamination. When landfills are full, they are often capped and transformed into parks or forests. Although this disposal option suits well in developing countries, very few countries use it because of lack of appropriate guidelines for location, design and operation systems,(Alkatib & Ali , 2001).

2.6 Integrated Solid Waste Management

Integrated solid waste management is a comprehensive waste prevention, recycling composit and disposal program (Sheba & Ogawa, 2007). An effective integrated solid waste management considers how to prevent human health and the environment. Although considerable efforts are being made by many goverments and entities in solid waste management there are still more to be done. The major ISWM activities are waste prevention, recycling, compositing, combustion, incineration and disposal to landfills. By use of appropriate segregation and recycling system, less waste can be diverted from landfills (UNEP, 2009).

2.6.1 Source Reduction

Reducing the waste before it is generated is a logical way to reduce cost as well save natural resources. It reduces costs involved in waste collection and disposal and helps in protecting the environment. A successful implementation of source reduction programme requires cordination of stakeholders, bussinesmen, industrialists, consumers, states and local goverments. Wastes can be reduced by minimising the consumption of raw materials (Noor, 2005).

Source reduction implies reducing the volume or toxicity of waste at the source by changing the material-generating process; it includes incorporating reduction in the design, manufacture, sale, purchase, and use of products and packaging. Other terms are often used to mean source reduction, including waste reduction, waste prevention, waste minimization, pollution prevention (Modebe *et al.*, 2011). While a number of individuals and businesses selectively participate in waste reduction effort, it would be very difficult to mandate communities. The option to waste reduction should be addressed at individual community levels, taking into account situations or conditions that favour such action (Zerbock , 2003).

2.6.2 Recycling and Compositing

According to (Shafiul *et al.,* 2003) recycling is usually the most environmentally friendly and cost effective method of waste management. Recycling at generation level can reduce waste reaching dumping site and landfills. It improves waste management process and also brings economic benefit to those involved. According to a study done in Malaysia, many people agreed that recycling is important but very few people practice it due to the lack of recycling facilities. Recycling is good, has merit, and is a familiar term to most people (Morrissey & Brown, 2004). However, the process is difficult to initiate and sustain without a clear understanding of what is required from the public and what monetary commitments are needed to succeed. Compositing refers to the controlled aerobic biological decomposition of organic materials such as food scraps and plant matter into humus. Compost acts as a natural fertilizer by providing nutrients to the soil (Wilson, 2007). Decomposing produces methane gas which can be used as fuel otherwise when released to the environment it is harmful as it is a greenhouse gas.

2.6.3 Combustion

Combustion refers to the controlled burning of waste in order to reduce the volume that has to go in the landfills and in some cases to generate electricity. Combustion can be employed for waste which cannot be prevented or recycled (Boadi & Kuitumen, 2004)

2.6.4.Incineration

Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials (Daniel Mereki & Balizan 2012). Incineration and other high-temperature waste treatment systems are described as "thermal treatment". Incineration of waste materials converts the waste into ash, flue gas and heat. The ash is mostly formed by the inorganic constituents of the waste, and may take the form of solid lumps or particulates carried by the flue gas. The flue gases must be cleaned of gaseous and particulate pollutants before they are dispersed into the

atmosphere. In some cases, the heat generated by incineration can be used to generate electric power.

Incineration with energy recovery is one of several waste-to-energy (WTE) technologies such as gasification, pyrolysis and anaerobic digestion. While incineration and gasification technologies are similar in principle, the energy product from incineration is high-temperature heat whereas combustible gas is often the main energy product from gasification. Incineration and gasification may also be implemented without energy and materials recovery. (Tumel *et al.,* 2016).

In several countries, there are still concerns from experts and local communities about the environmental effect of incinerators. In some countries, incinerators built just a few decades ago often did not include a materials separation to remove hazardous, bulky or recyclable materials before combustion. These facilities tended to risk the health of the plant workers and the local environment due to inadequate levels of gas cleaning and combustion process control. Most of these facilities did not generate electricity. Incinerators reduce the solid mass of the original waste by 80–85% and the volume by 95–96%, depending on composition and degree of recovery of materials such as metals from the ash for recycling (Entete,2010).This means that while incineration does not completely replace land filling, it significantly reduces the necessary volume for disposal. Garbage trucks in developed countries often reduce the volume of waste in a built-in compressor before delivery to the incinerator. Incineration has particularly strong benefits for the treatment of certain waste types in niche areas such as clinical wastes and certain hazardous wastes where pathogens and toxins can be destroyed by high temperatures. Examples include chemical multi-product plants with diverse toxic or very toxic wastewater streams, which cannot be routed to a conventional wastewater treatment plant.

Waste combustion is particularly popular in countries such as Japan where land is a scarce resource. Denmark and Sweden have been leaders in using the energy generated from incineration for more than a century, in localized combined heat and power facilities supporting district heating schemes. In 2005, waste incineration produced

4.8% of the electricity consumption and 13.7% of the total domestic heat consumption in Denmark (Raphael Odhiambo *et al.,* 2014).

2.6.5 Sanitary Landfill

Sanitary landfills include confining the waste, compacting it and covering with soil This presents a safer alternative to uncontrolled dumping of solid waste. A standard landfill is designed in a way that it can protect ground water from contamination and also avoids fires that would break out as a result of methane emission (Ogawa, 2005).

2.7 Environmental Impact of Poor Solid Waste Management

Adverse environmental impacts from improper solid waste management are rooted in inadequate collection, recovery of recyclable and disposal of solid wastes. These impacts are also due to inappropriate location, design, operation, or maintenance of dumpsites (Hudson and David, 2002). Improper solid waste management activities are associated with various environmental impacts such as contamination of water sources. Rotting wastes have long been an eyesore in management; most of them do not succeed due to social economical and technical problems (Pokhrel, (2005).

2.7.1 Threats to Public Health

In developing countries, solid waste management emerges as a problem but unfortunately, it is given low priority (Priya*et al.*, 2003). Poor collection and disposal of domestic solid waste causes public health problems. This aggravates poverty and leads to negative consequences such as loss of income due to illness, and increased spending on health care. Diseases related to poor solid waste management are malaria, enteric diseases, and respiratory ailments (Hester & Harrison, 2002).

2.7.2 Air and Atmospheric Pollution

When organic waste is disposed of in open dumps, they undergo anaerobic degradation. This becomes significant sources of methane, a gas which traps heat in the atmosphere (Nziediebe, 2009) Burning of garbage creates thick smoke that

contains carbon monoxide, soot and nitrogen oxides. These are hazardous to human health and degrade urban air quality. Combustion of Polyvinyl Chloride(s) (PVCs) leads to emission of Volatile Organic Compounds (VOCs) and generates highly carcinogenic dioxins (El Fidel, 2006).

2.7.3 Vegetation Damage

A study done in Kampala showed that poor domestic solid waste management has negative effect on people's immediate environment or on wider environment (DEAT, 2002). Damage of vegetation appears due to oxygen deficiency, which causes death of plants. Plastic materials scattered on land impairs the plant development (*Krishna* & Sankh, 2007).

2.8 Factors Associated with Solid Waste Management

According to Benjamin and Monsoor (2004) lack of awareness on impact of poor solid management can lead to poor practices. There is need to improve public awareness programs and community participation in solid waste management. Family size and level of income affects solid waste management. Those with high in come can afford to pay for garbage collection. The larger the family the most solid waste generated (Zhu *et al.*, 2008). Collection, transfer and transport practices are affected by improper bin collection system and lack of enough vehicles (Ekele *et al.*, 2009). According Tai *et al.* (2011), factors associated with solid waste management practices in a community are family size, their education level, income, lack of law enforcement and altitudes towards solid waste management.

2.9 Laws Governing Solid Waste Management in Kenya

The laws and regulations governing solid waste management in Kenya includes Public Health act, Environment management and co-ordination act (EMCA, 1999), and the County of Nairobi waste management by laws. Section 87 of EMCA 1999 prohibits discharge or dispose of any waste in a manner that would cause pollution to environment or ill health to any person.

The local government act cap 265 section 160 gives local authority power to maintain sanitary services which includes solid waste management. The public health act cap 242 section 118 explains that any noxious matter or accumulation of refuse or solid waste discharged in a way that is injurious to health and environment is an offence (public health act, 2012). It also states that it is the work of local authority to maintain cleanliness and prevent nuisance.

In occupation and health act (OSHA, 2007), any employer is required to develop a sustainable safe collection and disposal of solid and liquid waste to avoid risk to the environment and human health. The fourth schedule in constitution of Kenya part 2, county governments are responsible for collection and disposal of solid waste (Constitution of Kenya, 2010)

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

The study was carried out in Gitothua ward of Ruiru Municipality of Kiambu County. The municipality extends between latitude 34^0 50^0 and35^0 37^0 east and degrees 0" and 0 degrees 55" north. Ruiru municipality is located 3km from the boundaries of Nairobi city along Thika highway. Ruiru is connected by both rail way and road. It is surrounded by numerous coffee plantations. It consists of 8 wards among them Gitothua.

Figure 3.1: Ruiru Town on the Thika – Nairobi Superhighway

The total area of Gitothua residential estate is 20.70 square kilometer. The number of household in Gitothua is approximately 5006 with of a population of 18,083. Gitothua ward is divided into two sub locations namely Gitothua and Mukuyu with five villages. People from different ethnicity occupy the area. The residents work in coffee plantations, flower farms, construction sites, business, civil service and private sectors. The sources of water in the area are boreholes shallow wells, tapped water and rivers. Gitothua population is growing very fast due to affordable houses. The developers are ahead of the planners and this leads to poor planning when erecting buildings thus leading to indiscriminate dumping of solid waste.

Figure 3.2: Map of area of Gitothua Ward: https://www.google.co.ke/maps/

3.2 Study Design

This was a cross sectional study design meant to assess the status of domestic solid waste management in Gitothua ward of Ruiru Sub County.

3.3 Study Population

The study population was adults in the households

3.3.1 Exclusion criteria

The adult in the household who was not willing to participate was excluded in the study.

3.4 Sample Size Determination

The study adopted the following formula by fisher *et al* to determine the sample size

$n=N/ 1+ Ne^2$

n= Minimum required sample

N=Population size= 5006

e= margin error (0.05)

5006/1+5006x0.05x0.05=370

Sample size= 370

3.5 Sampling Techniques

A list of households was obtained from the District Statistical Office, Thika. The ward contained 5,006 households. The ward was divided into five villages; namely Gitothua, Membley, Tatu, BTL and Mukuyu using administrative boundaries. Systematic sampling was used to have the sample frame. Since most of the houses were not well

planned with serial numbers, serpent movement was used to select the k^{th} house starting from the direction of first house contact. The households in each village were selected using systematic sampling where the first house in each village was randomly selected. In a house which had more than one adult, the first one to be contacted was interviewed.

Table 3.1: Systematic sampling procedure used in the study

Village	No of household	No interviewed	Sample fraction
Gitothua	1380	74	Every 19^{th} house
Membley	1006	74	Every 14^{th} house
BTL	1100	74	Every 15^{th} house
Tatu	720	74	Every 10^{th} house
Mukuyu	800	74	Every 11^{th} house

3.6 Data Collection Tools

3.6.1 Questionnaire

The questions were both close and open ended. The closed ended questions required the participant to make choices from alternative response while open ended questions were provided with a space to give their own views. Three research assistants were employed to assist in collecting data. For the semi literate respondents, questions were translated into the language which they understood for accuracy of the data.

3.6.2 Observational Checklist

In addition to questionnaires, observational checklist was used. This field observations helped to compare the actual state of the study area with the information gathered through household questionnaires. In the course of field observation, photographs of waste scenes such as street litter, chocked drains and open dumpsite were taken.

3.7 Research Variables

The Conceptual framework illustrated the relationship between independent and dependent variables. Dependent variable involves solid waste management practices which includes; separation, proper storage, collection, reduce, reuse, recycling and proper disposal. The independent variables however comprises of family size, gender, level of education, income level. Solid waste management practices depends on various factors as shown in the diagram i.e. education level, gender, age, income level and family size.

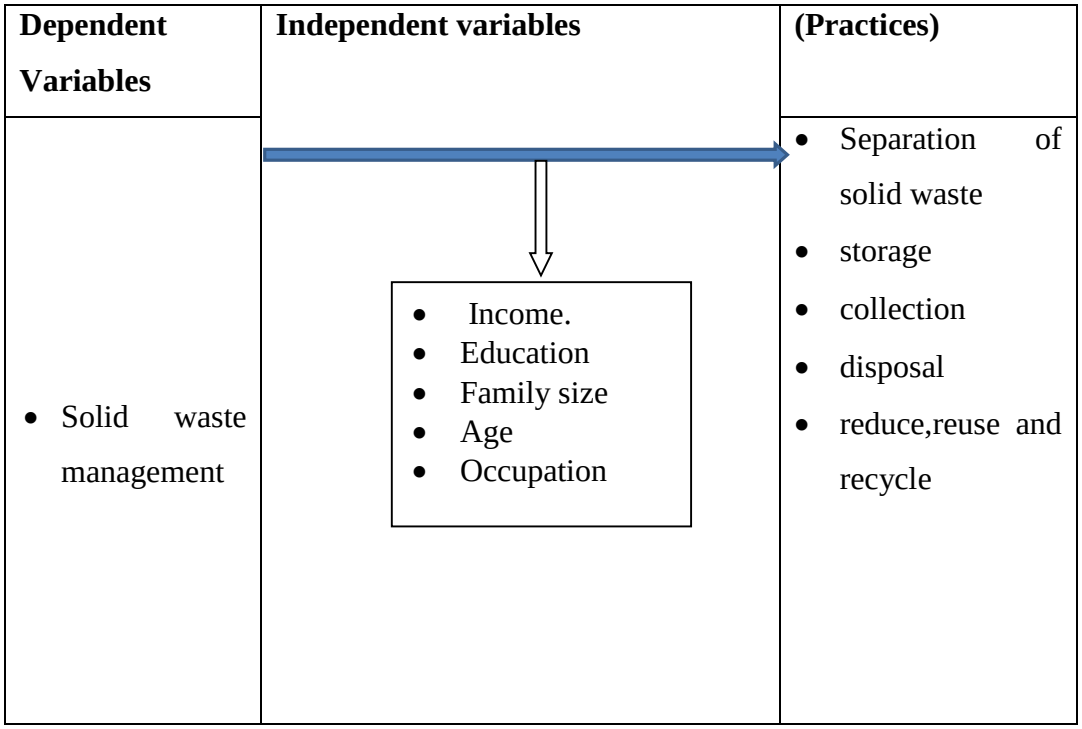

Figure 3.3: Conceptual framework

3.8 Data Management and Analysis

Data obtained from the field in raw form was subjected to quality checks to ensure that the recordings were correctly done with minimal errors. Quantitative data from the field was obtained by use of questionnaires which were sorted and those with inconsistent response were left out. The data was later scored, coded and entered for

analysis. The recorded data was analyzed with the aid of Statistical Package format (SPSS) version 2.0. File backup was regularly done to avoid any loss or tampering. All exposure variables (Independent factors) were associated with the dependent variable to determine which ones had significant association. Odds Ratio (OR) and 95% Confidence Interval (CI) were used to estimate the strength of association between independent variables and the dependent variable. The threshold for statistical significance was set at $\alpha = 0.05$ and a two-sided p value at 95% confidence intervals (CI) reported for corresponding analysis. Multiple logistic regressions were specified in order to adjust for confounding. Adjusted odds Ratios (AOR) with the respective 95% Confidence Interval (CI) was used to estimate the strength of association between the independent and dependent variables.

.3.9 Ethical Consideration

A number of ethical issues were addressed before the study started. The members of the community were prepared for the study by the help of community health workers in the area. A verbal explanation of the purpose of the study, procedure, benefits and who to contact was given to the respondents. The respondents were assured that participation was voluntary and they would choose to participate or not without any penalty. The respondents who agreed to participate were requested to sign the consent form. To ensure confidentiality and privacy no names were used in the questionnaire and the information collected was only used for the purpose explained by the author. Approval from other relevant authorities was also sought. This included the KEMRI scientific steering committee (SSC) and ethical review (ERC) committee.

.

CHAPTER FOUR

RESULTS

4.1 Demographic characteristics of study subject

A total of 370 respondents participated in the study.

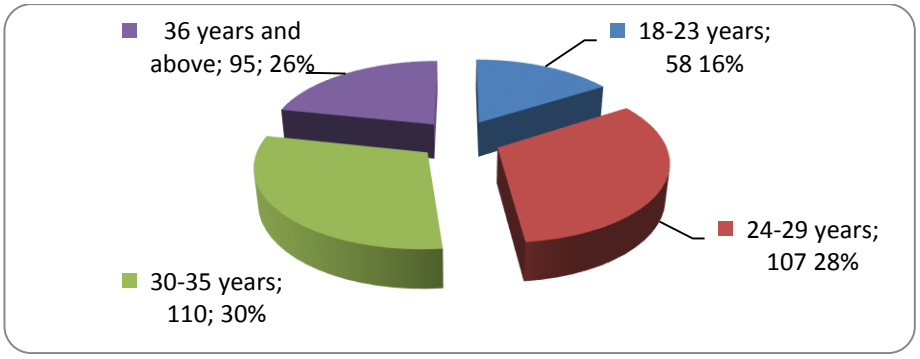

Figure 4.1: Distribution of study participant by age

The numbers of female were 62% while 38% were male. 28% of the respondents were aged between 24-29 years of age, 26% were between 36 years and above while 30% were between 30-35 years of age.

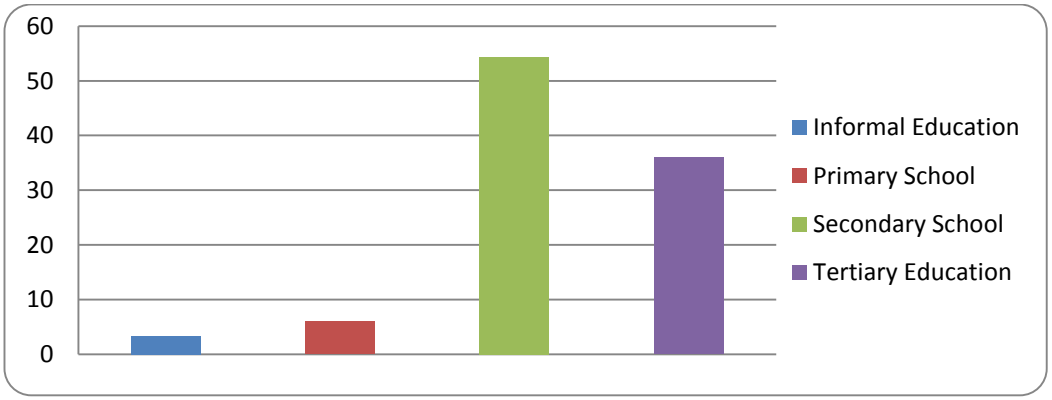

Figure 4.2: Distribution of study participant by level of education

Figure 4.2 shows that majority (54.3%) of the respondents had attained secondary school education and 36% had attained tertiary education.

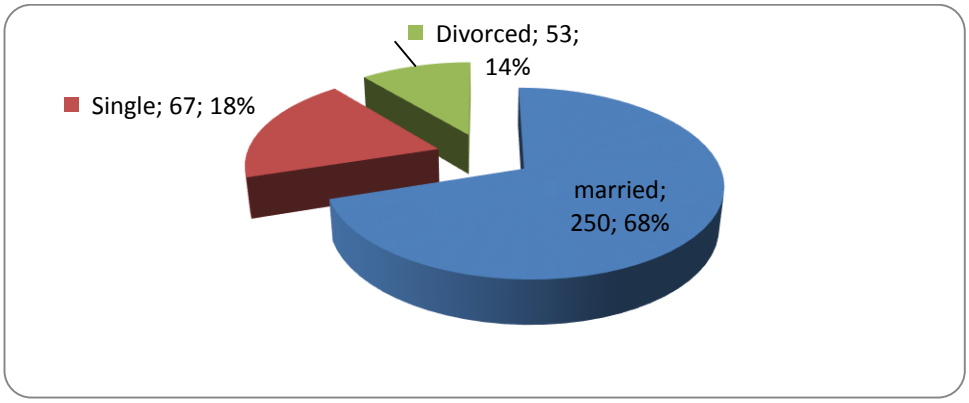

Figure 4.3: Distribution of study participant by marital status

Fig 4.3 shows that 68% of the respondents were married while 18% were single.

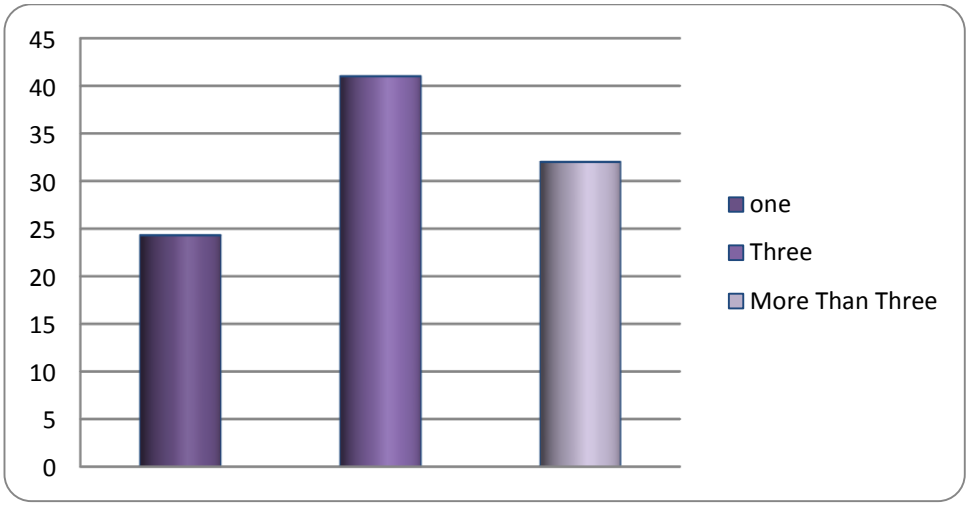

Figure 4.4: Distribution of study participants by family size

Majority (41%) of the respondents had a family size of three members, while 32% had more than three family members and 24.3% lived alone (Figure 4.4).

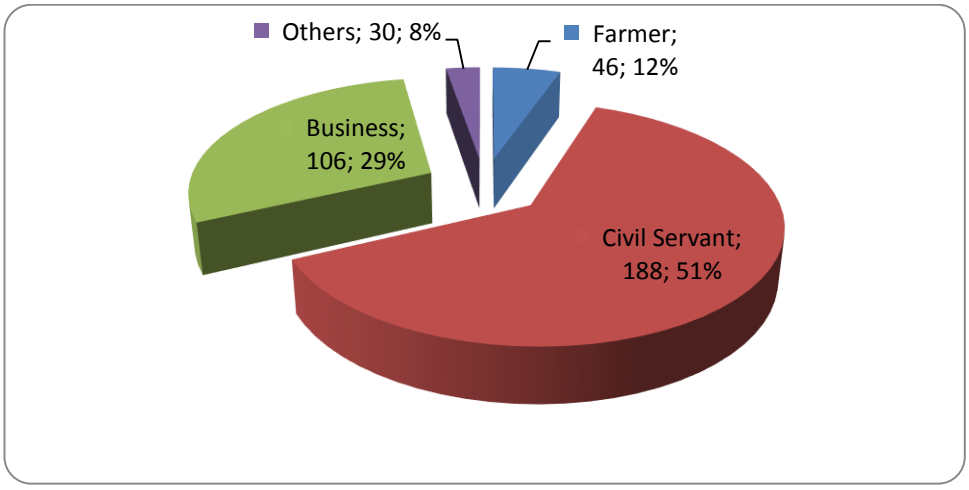

Figure 4.5: Distribution of study participants by occupation

A majority (51%) of the respondents indicated that they were civil servants while 29.3% were businessmen, 12% were farmers and others 8% (Figure 4.5).

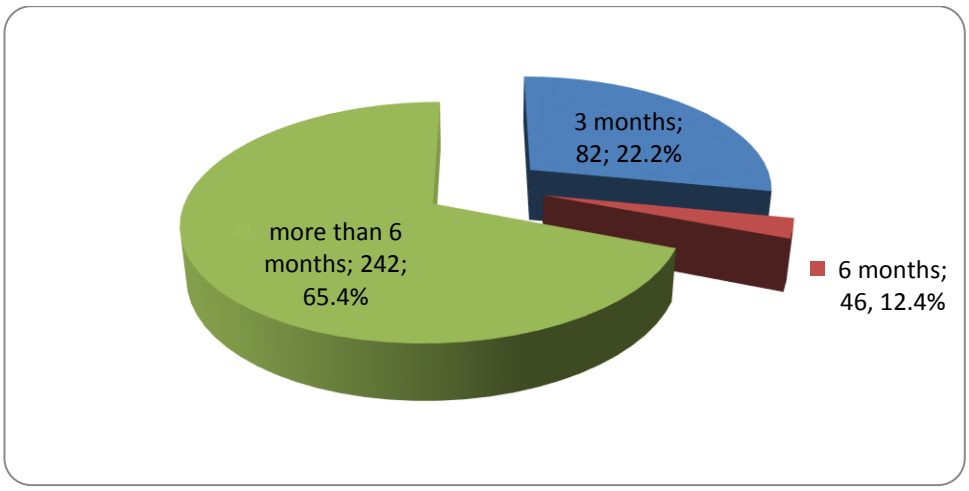

Figure 4.6: Distribution of study participants by duration one has lived in Gitothua

Fig 4.6 shows that 65.4% of the respondents indicated that they had lived in Gitothua. for more than 6 months, 22.2% had stayed for only three months and 3 months 12.4.

Table 4.1: Types of solid waste generated in Gitothua

Types of solid waste	Frequency	Percentage
Plastics	100	27
Foodstuffs	100	27
Polythene papers	80	22
Metals	30	8
All of the above	60	16
Total	370	100

The types of the solid waste generated in the area are shown in Table 4.1. Plastics and food waste comprised of 54% of the solid waste followed by polythene paper bags at 22%

4.2 Solid Waste Management Practices in Gitothua

Table 4.2: Household Practices on Solid Waste Management in Gitothua

Practice		Frequency	Percent
Waste separation	No	230	62
	Yes	140	38
	Total	370	100
Type of waste container	Paper bag	171	46
	Bucket	101	27
	Sack	36	10
	Metal bins	62	17
	Total	370	100
Waste container provider	Self	238	64
	County office	53	14
	Private company	79	22
	Total	370	100
Frequency of collection	Weekly	111	30
	Twice week	73	20
	Not collected	186	50
	Total	370	100
Means of transport	Wheelbarrow	50	14
	Council vehicle	150	35
	Private vehicle	130	41
	Others	40	10
	Total	370	100
Reuse and recycle	No	282	76
	Yes	88	24
	Total	370	100
Methods of disposal	Open dumping	202	55
	Burning	112	30
	Compositing	56	15
	Total	370	100

The survey revealed that 62% of the respondents do not separate their waste while 46% indicated they used paper bags as their waste containers. Majority of the respondents indicated that the waste containers were theirs, while 22% indicated that they were supplied by private companies and 14% indicated supply by county office. In regard to frequency of collection , 50% of the respondents indicated that their solid

waste is not collected. In regard to transport and collection payment, only 35% make use of county vehicles while 44% pay for collecion. Majority (55%) of the respondents indicated that they disposed their wastes by open dumping .

Table 4.3: Meaning and impact of poor solid waste management

		Frequency	Percent
Meaning of domestic waste	Unwanted materials left from human activities	276	75
	Something hazardous	61	16
	Broken items	33	9
	Total	370	100
Value of domestic waste	No	150	41
	Yes	220	59
	Total	370	100
Impact of poor solid waste management	Polluting air,water & land	318	86
	Ill health	52	14
	Total	370	100
Diseases related to poor solid waste management	Malaria,typhoid,cholera	297	80
	Hepatitis,yellow fever	73	20
	Total	370	100

Majority of the respondents (75%) knew that waste is unwanted materials left from human activities, 72% acknowledged that waste management was a problem in their area while **57%** pointed out that the waste management problem was serious. Only

59% of the respondents indicated that waste can be of value. The respondents pointed out the common diseases attributed to poor solid waste management in their area and 80% of them mentioned malaria, TB, typhoid, and cholera while 3% indicated hepatitis and yellow gever and 17% were not aware.

4.3 Field Obsevation

Plate 4.1: Open drain clogged with solid waste

From the above clogged drainage system it can be seen clearly the deleterious effect of the plastics which form the common solid waste in this area. These polythrene bags are commonly used as wrappers for shoppings and packagings for various food products.

Plate 4.2: Open drainage used as dumping site in dry season

The open drainage system acting as a dumping site for gabbage is a sore sight. When it rains the system is clogged up ending with stagnant water in many areas. Domestic and wild animals and birds can be seen foraging on the waste. Bleeding grounds for vermin is thus generated.

Plate 4.3: Indiscriminate dumping on vacant land

Vacant plots and common utility land e.g. roads are also used as dumping sites

4.4 Multivariate Analysis

Binary logistic regression was used to model relationship between demographic characteristic and solid waste management practices**.** The age group of 36 years and above compared to 18-23 years was associated with solid waste management practices (p=0.003). The odds of having sound practices were 14.192 times higher for those aged over 36 years and above compared to those aged between 18-23 years.

Family size of three members was statistically associated with solid waste management practices (p=0.000). The odds of havingsound practices higher for those with a family of three compared to those with less family size. Refer to appendix 6

CHAPTER FIVE

DISCUSSION

5.1 Discussion

A total number of 370 respondents participated in the research of which 56.3% were female and 43.7% were male which shows a normal distribution of households in the settled area under the study. The type of domestic solid waste commonly generated was organic food stuff waste, plastics and polythene papers commonly used for packaging. This agrees with a study done in Nigeria by Entete (2010) which showed similar trend of domestic solid waste management. The raw or cooked food waste when left uncollected attracts insect such as flies, cochroaches and produces foul smell which pollutes the environment. Plastics and polythene papers are among the non- bio gradable wastes. Accumulation of these waste encourages retention of pockets of water even in dry seasons which act as breeding grounds for mosquitos. The plastics also block drainage systems causing temporary water ponds during rainy seasons and diverting the normal drainage system. These plastics are also eaten by domestic animals like goats, sheep and cows causing death to most of them.

Normal solid waste practices includes; separation at source, proper storage, frequent collection, reuse, recycle and transportation to final disposal. The study findings showed that 62% of the respondents did not separate their waste. This agrees with a study done in Ghana Accra by Omran (2009) that showed that majority of the respondent did not separate their domestic waste. 46% of the respondents indicated that they used polythene paper bags as their general utulity household containers. 64% of the respondents indicated that they provided the solid waste disposal bags themselves, while 22% indicated private company and 14% indicated town council provided the containers. According to Ikiala (2004), recommended waste receptacle is the one which is durable, water tight and has a handle to facilitate collection and should be kept clean. From the transect walks across Gitothua the researcher observed that the residents used broken plastic buckets which could not hold the waste for long.

The researcher also found that some of the households use the polythene papers they get after shopping in storing wastes. These are later disposed of indiscriminately. The findings agree with a study done in Nakuru by Chris Zurberg, 2007 which showed that those people who used different types of polythene paper bags disposed them indiscriminately. This could be so because the residents are not provided waste paper bags or dustbins by the muncipal council. Most of the residents cannot afford to pay for private garbage collection services. According to good solid waste management practices, containers for storing solid waste must be prevented from access by domestic animals and vermin. This is a big contrast from the open and unprotected broken containers used by most households in Gitothua.

In Gitothua 30% of the sampled residents indicated that the frequency of solid waste collection was weekiy, 20% indicated twice per week and 50% informed that solid waste is not collected at all. From the observation done during the study, evident accumulation of the garbage supported the non collection of the domestic solid waste. This agrees with a study done in Ghana by Chris Zurberg 2007 which showed that frequency of solid waste collection was irregular which leads to accumulation of the same. The accumulation of domestic solid waste attracts insects and pests which can lead to outbreak of diseases related to poor sanitation e.g malaria, plague and cholera. Majority (55%) of the respondents indicated that they disposed their wastes by open dumping as evident by Fig 4.8 and Fig 4.9. This agrees with a study done in Nigeria by Momoh (2010) where solid waste accumulated in open drains due to indiscriminate dumping. According to Alkatib and Ali (2001) efficient domestic solid waste management system is the one that provides ecologically sound disposal option for the waste that can be reduced ,recycled, composited, combusted or processed further. Engineer land fill sites are the most appropriate place of final disposal for solid waste whether they are incinerated or recycled there would still be the need for some form of land filling. Land filling option is not practiced in Gitothua according to the study results.

In regards to the meaningof solid waste management in Gitothua, (79%) indicated that they knew the meaning. This differs with a study done in mega cities of Africa by Lacoste (2007) which showed only a small percentage (22%) knew what domestic solid waste means. Majority of the respondents indicated that they knew the value of domestic solid waste yet 76% do not reuse or recycle. This agrees with a study done by Shafiul *et al.* (2003) which showed that although recycling is the most environmentally conscious and cost effective method of waste management as it reduces waste reaching dumpsite , but very few people practices it. The results indicate that the residents of Gitothua are enlightened in the ways of waste disposal but they have no ability to implement it. There are no stipulated waste collections centres and that leads to waste dispasal all over the area.

In regard to what could be some of the effects of poor solid waste management, 86% of the respondents indicated pollution of air, water and land while 14% indicated ill health. This concurs with a study done in Kampala by Krishna (2007) which showed that majority of the people knew the impact of domestic solid waste accumulation yet their waste management practices were poor. 80%f of the respondents indicated Malaria, TB, Typhoid, and Cholera are the consequences of uncollected domestic waste while only 17% showed ignorance of the diseases related to poor solid waste management. This showed that majority of the respondents were aware of consequeces of poor domestic solid waste management. Poor collection and disposal of domestic solid waste causes public health problems. Poor segregation and poor choice of technology for treatment and disposal of domestic waste are two problems identified that are due in part to inadequate man-agement practices or simply because of absence of adequate provision of waste receptacles. Uncollected garbage aggregates poverty and leads to negative consequences such as loss of income due to illness, and increased spending on health care. Diseases related to poor solid waste management are malaria, enteric diseases, and respiratory ailments (Hester & Harrison, 2002).

In regards to the factors associated with practicing sound solid waste management in Gitothua. The age group of 36 years and above was associated with solid waste management practices ($p=0.003$) as compared to 18-23 years. The odds of having good

practices were 14.192 times higher for those aged over 36 years and above compared to those aged between 18-23 years. The age descrepancy could not be well explained but the results agreed with a study done in Nima by Fredual G which showed that elderly people have good practice in domestic solid waste management.

Family size was associated with solid waste management practices (p=0.000). The odds of having sound practices were higher for those with a family of three compared to those with less family size. This could be so because of the amount of domestic solid waste generated in a large family will generate huge volume than in a small family.

At the time of data collection, heaps of solid waste was found in the vacant land, along the streets and in the open drains. This would lead to blocking of drains, land pollution and air pollution. During rains, stagnant water from blocked drainage system would form water ponds which would in turn be the bleeding grounds of mosquitoes and other domestic animals.

A study done by Ong'unya *et al*. (2014) in Nairobi recommended that: consumers to be educated on the health hazards that emanate from poor disposal of plastic wastes and the Kenya government to legislate sound laws on plastic waste management to strengthen the by-laws for effective reinforcement in the city solid waste management. The reported study results are similar to a study done in Nigeria by Momoh (2010) that showed that solid waste was dumped on roads, undeveloped land and in open drainage. During the time of data collection, the reseacher noted that only one vehicle was used in collection of solid waste in Ruiru sub county and this agrees with the participants who indicated that the collection of solid waste was ineffective. One vehicle is not enough to collect all the waste generated in the densely populated area and this could be the reason for accumulation of the solid waste in this area. From the data obtained from the laws governing solid waste management, the county goverment of Kiambu has the mandate to keep the environment clean. Every Kenyan has the righ to a clean and environment as by (EMCA, 1999) and public health act Cap 242. Provision of garbage clearing services are a right to the public and therefore the County government

is breaking laws by not providing adequate service. The services which should be offered by the county goverment are provision of dustbins, frequent collection of solid waste and disposal of the same.

CHAPTER SIX

CONCLUSION AND RECOMENDATIONS

6.1 Conclusion

1. The main types of domestic solid waste generated in Gitothua were food remains, plastics,papers and polythene papers.

2. The analysis showed that a big proportion of the respondents did not seperate their waste at source.

3. The major storage receptacles used were polythene bags most of which were torn pouring out waste.

4. The collection of the solid waste by the county goverment is irregular.Only 50% of the solid waste generated is collected.'The collecton vehicles are few.

5.The method of disposal mostly used in Gitothua is open dumping which leads to bleeding sites of insect and clogging of drainages.

6. In general the study showed that there is a gap in solid waste management in the area of the study ie seperation,storage,collection reuse, recycle and disposal

6.2 Recomendations

1. The county goverment to conduct seminars on domestic solid waste management in the area to enlighten the residents on the clean environment.

2.Povision of standard storage receptacles by the county goverment in Gitothua

3.Regular collection of domestic solid waste by addation of collection vehicles.

4.Povision of a landfill as a proper method of disposal which should be well managed to avoid ground water contamination.

REFERENCES

Alkatib, I; & Ali, B. (2001). Principle and management of solid waste. *University of Malaysia Training Manual 3,* 6-9.

Banga, W., (2004). Household knowledge, altitude and practices in solid waste segregation and recycling. *Zambia social science journal,* 2, 27-39.

Benjamin, B, & Mansoor, A. (2004). Sampling household waste at source, *Journal of waste management and research, 22*(3), 142-148.

Beukerung, G. & Gerlagh, C., (2001). Analysing urban waste in developing countries. A perspective on Bangalore India, *working pape*r NO.24: 739-742.

Boadi, T., & Kitumen, B., (2006). Solid waste management in the Accra metropolitan area in the Environmental. *Environmental journal* 23(3).

Chris, O., & Zurberg, R, (2007). Collection and transportation of solid waste in urban centres. *American Journal of industrial medicine*, *3,* 243-244.

Constitution of Kenya, (2010). Published by Kenya government printers, Retrieved from: *www.kenyalaw.org.*

Daniel, M., & Baizhan, H. (2012). Household's perceptions on solid waste management practices in developing countries. *Waste management Journal,* 6, 246-253.

Department of Environmental Affairs and Tourism (DEAT), (2002). *National waste management strategy action plans guide and Handbook* pp.23-45. New York: MC Graw-Hill

Environmental Protective Agency (EPA) (2007). Domestic waste management facility criteria, Technical manual PA 530-R-93-017

El Fidel, G. (2006). *Municipal solid waste management in Accra Metropolitanarea*, Ghana: Kluwer Academic Publishers.

Ekele,G, Mugisha ,T (2009) Factors influencing waste separation and utilization among households in the lake Victoria crescent, *Uganda journal of waste management*, *29*, 996-1002.

EMCA, (1999) Environmental Management and coordination Act (2012) Published by the national council for law reporting from the authourity of attorney general *wwwkenyalaw.org assessed 13 July 2014*

Entete, C, (2010). Potential impacts of climate change on solid waste management in Nigeria. *Sustainable journal of development in Africa, 12,* 101-103.

Fauzia, S.H. (2009). Municipal solid waste management in Malaysia. *Malaysia journal of science, 23*(2), 61-70.

Fredual, G. (2007). Problems of solid waste Management in Nima/ Accra. Undergraduate *research journal for human science, 6,* 10-11.

Gakunga, J., & Otieno, F.A O,H. (2012). Castor. *journal of engineering, 5*(3), 127-128.

Hester, R.E. & Harrison, R.M (2002). Environmental and Health Impact of Domestic waste management activities: Issues in environmental science and Technology. *Environmental journal in Malysia, 4*, 19-21.

Hudson F, & David, F.M. (2002). Solid waste generation and service quality. *Journal of Environmental Engineering, 103*(2), 935-946.

Ikiala, M. (2004). *Handbook of collection of garbage in developing countries*. Vol 2, PP 711. New jersey: MC Graw-Hill

Iqbal, H., & Khan N. (2014.). *Textbook of Solid Wastes Management*. (2nd ed.). by Frank Kreith 2 PP. 2-7 London: Prentice Hall.

Kaseve, M.E. & Mbulingwe, K. (2005). Appraisal of solid waste collection following private sector in Dar es Salaam. *Habitat international, 29,* 353-356.

Kharbanda, M., & Williams, L. (2001). Management of municipal solid waste in the developing countries, *Environmental health journal in India, 5*, 10-13.

Krishna, H, & Sankh, P. (2007). Domestic waste management, *Journal of Agriculture and Environment*, 8, 55-61.

Lacoste, M., & Judith, P. (2007). Effective waste management, Understanding and dealing with public concerns, *Waste management and research journal*, 12(3), 207-222.

Mangizuo, P. (2008). Management practices at the Mucheke municipal solid waste disposal in Masvingo city in Zimbabwe" *Journal of Sustainable Development in Africa 10*(2), 147-164.

Morrissey, B.F. &Brown, L. (2004). Integrated solid waste management based on the 3r approach, *Journal of materials cycle and waste management, 12*(1), 30-40.

Momoh, J, & Oladebeye, J. (2010). Assessment of awareness of attitude and willingness of people to participate in household solid waste disposal. *Journal of Applied Sciences in Environmental Sanitation, 3*.

Modebe, U., Ezieama, N.N., & Ogbuagu, C.N. (2011). Public health implication of household solid waste management in Awk in south eastern Nigeria.*The journal of public health* 1: 46-50

Noor, M.Z. (2005). Scenario of solid waste management in developing countries, A case study, (Preconference*). Professional training program on solid waste management in sea cities*, 4-5.

Nziedibe, C. (2009). Solid waste reforms and recycling in Enugu area, Nigeria. *Habitat International, 33*, 93-99.

Ngoc, U.N., & Schntzer, H. (2009). Sustainable solutions for solid waste management in south east Asian countries, 29(6), 1982-1985.

Oberlin, A.S., & Szanto, G.L. (2011). Community level compositing in developing countries. *Waste management and research journal, 29*(10), 1071-1077.

Ogawa, H, (2005). Sustainable solid waste management in developing countries Retrieved from:www.gdrc.org.

Omran, A. Mohammed, A , & Abdul, A., (2009). Investigating household altitude towards recycling of domestic waste in Malaysia*; International journal of environmental research, 3*(2), 275-288.

Ong'unya, P., Raphael, O, Aurah, C. & Musalagani, N., (2014). *International Journal of Current Research, 6*(04), 6175-6179.

Petersen, F. & Hamada, M. (2006). Analysis of residential solid waste at generation sites. *waste management journal, 15*, 395-409.

Pokhrel, T. (2005). Municipal solid waste management in Nepal, Practices and challenges, of waste management pp:555-562 Retrieved from: http://www.sciencedirect.com

Priya, N., & Kumar, A. (2003). Perceptions of domestic waste management in Africa. *Medical Journal, 10*, 122-125.

Public health Act, (2012). Public health act laws of Kenya, Retrieved from: www.faolex.fao.or .docs

Ruiz J.R., (2001). *Recycling Handbook* (pg. 2-10), (2nd ed.). New York: MC Graw-Hill

Senkoro, H. & Sundari, S. (2004). Domestic and commercial solid waste management. *The Indian journal of social work 12,* 67-88.

Shafiul, A., Jaffe, R., Alter, A. & Kreith, F., (2003). *A Hand book of waste management,* (vol. 2: pp 37-47). New York: MC Graw-Hill

Sheba, K. & Ogawa, H. (2007). *Model for municipal solid waste disposal options* (vol. 28 PP 1500-1508). New York: MC Graw-Hill.

Sira, F.N. &Christina, G. (2004). Solid waste management in urban cities in Nairobi *Environmental Health Journal*, 5, 44-50.

Tai, Z, & Feng, O. (2011). Municipal solid waste collection in China. *Journal of waste management, 31*, 1673-1682.

Tsiboel, N. (2004). *Evaluating environmental impacts of solid waste management alternatives.* Bio cycle, pp. 52-56. New jersey: MC Graw-Hill.

Tumelo, T., Kwalane, W., &Thando, D. (2016).Challenges of domestic solid waste management, A case study of Lobatse Botswana, *Geographical review, 35*(2).

UNEP, (2009). Developing integrated solid waste management plan. *Training manual* 2, 6-7.

United States Environmental Protection Agency (2009).integrated solid waste management. 2

Vision 2030, Government of Kenya

Wilson, P.D.C. (2007). A Whiteman and A.D Read, Strategic planning for solid waste management. *An interactive toolkit for developing countries, 4*, 55-60.

Zerbock, O. (2003). Urban solid waste management and waste reduction in developing countries. Retrieved from: Www.cee.mtu.edu.

Zhu, D., Asan, M. (2008). Improving municipal solid waste management in India, Geneva: World bank

Zurbrugg, C. (2009). Solid waste management in developing countries Retrieved from: www.sani.con.org

APPENDICES

Appendix 1: Informed consent

My names are Priscilla Gathigia Njogu, a master's degree student at Jomo Kenyatta university of Agriculture and Technology, College of health sciences. I am the principal investigator of this study.

Purpose of the study

The purpose of the study is to assess domestic solid waste management in Gitothua residential areas.

Study procedure

The principle investigator will give questionnaires to the heads of the households who will agree to participate. The principle investigator requests the participant to give permission by signing the consent form.

Research benefit

There may be no direct benefit by participating in the study. However, I may find an opportunity on measures to improve on solid waste management in Ruiru municipality

Risk

There is no risk to the respondent by choosing to participate in the study.

Confidentiality

All information will be confidential. No names will be used and the exercise will be voluntary. The participant will be free to leave the exercise without any penalty.

Contacts

In case of further questions, comments or complaints relating to the research you can contact the investigator through +254-0710711737, Mail gathigianjogu@gmail.com

Please ensure that you have fully understood what is involved in participating in this study and that your role as respondent has been fully explained to you.

Participant statement

I ---------- hereby give consent/assent to ---------- to participate in this study that is aimed at assessing the management of solid waste among community in Gitothua, Ruiru Municipality of Kiambu County.

Participant signature ----------

Appendix 2: Questionnaire

1. Gender

(1) Male…….....☐

(2) Female…….....☐

2. Age

(1) 18-23……. ☐

(2) 24-29……..... ☐

(3) 30-35…….. ☐

(3) 36 and above…….. ☐

(3. Educational background

(1) Informal education……. ☐

(2) Primary…. …….. ☐

(3) Secondary……. ☐

(4) Tertiary……. ☐

4, Size of the family

(1) One……. ☐

(2)Three……. ☐

(3) More than three……..... ☐

(4) Others specify…….

5. Marital status

☐

(1) Married……

(2) Single……☐

(3) Divorced……☐

6. Occupation

☐

(1) Farmer……..

(2) Civil servant……☐

(3)Business……☐

(4)Others specify…….

7. How long have you been a residence in Ruiru

(1) Three months……..……☐

(2) Six months……..……☐

(3) More than six months……☐

(4)Others specify……

8 What does the word solid waste mean?

---

9. Is solid waste management a problem in this area?

(1)

Yes…….....…….....….....…….....☐

.....

(2)

No…….....……☐

.....

10. In your opinion how serious is the problem of solid waste management?

(1) ☐

Serious…….....…….....

(2) Not ☐

serious…….....…….....

(3) Don't know……

11. What forms of wastes are commonly generated in your house?

(1) Plastic ☐

wastes…….....…….....

(2)Food stuff

wastes…….....…….....

(3) Metal

wastes…….....…….....

(4)Paper

wastes…….....…….....

(5)All of the

above……..

(6) Others specify…….

18. Do you separate your solid waste before storage?

(1)Yes…….....

.....

(2)

No…….....……

.....

19. Do you have a waste container?

(1)Yes…….....……

….....

(2)No…….....……

…….....

17. If yes what type of container?

(1)

Bucket…….....……...

.....

(2) Paper

bag…….....…….....

(3)

Sack…….....……...

.....

(4)Metal

bins…….....

(5) Others specify……

18. Who provided the container that is used on your premise?

(1)

Self…….....……..

.....

(2)Town

council…….....….....…….....

(3) Private

company….....…….....

(4) Others specify……..

19. How often do you empty your container?

(1)

Daily…….....…….....

.....

(2)Twice a

week…….....…….....….....

(3)Weekly…….....……...……....…….

.....

(4) Others specify…….....……

20. Where do you empty your container?

(1) Within the same

apartment…….....……....……..

(2)Outside the

house…….....…….....

(3) Open

space…….....….....

(4) Collection

vehicle…….....

(5)Others specify……

21. How do you dispose of your solid wastes?

(1)Open

dumping…….....…….....

(2)

Burning…….....

(3)Compositing…….....

(4)Others Specify.....

22. How long does it take to collect that accumulated solid waste for disposal?

(1)

Daily…….....……

(2)Twice a

week…….....

(3)Weekly…….....…….....

.....

(4)Not

collected…….....…….....

.

23. who collects solid waste from your house hold?

(1) Private

company…….....……

(2) County

government…….....……..……..

(3)Self…….....……

……

(4)Others specify…….

24. Who transports your solid waste to disposal site?

(1) Family members……..….....……

(2) Private company…….....

(3)County government…….....……...……...……..☐

(4)Others ☐

specify….....…….....……

25. How is your waste transported?

☐

(1) Use of wheel

barrow…….....…….…...……. ☐

(2)Companies vehicle…….....……...……..…….

(3) Council vehicle…….....……...……..…… ☐

(4)Others specify……

26. Do you pay collection fees?

☐

(1) Yes…….....……...……

(2)No…….....……...…… ☐

27. If yes, how much per month, week or year

28. What is your opinion of the service that you are receiving?

(1) Effective…….....……. ☐

(2) Not effective…….....……..…… ☐

29. What are some of the environmental impacts of poor solid waste management?

…….

…….

---

30. Do you think that solid waste can be of any value?

---

(1)Yes…….....……..……..

…

(2) No…….....……..

If yes of what value? ----------

31. Do you re-use some of your domestic waste?

(1)Yes…….....

(2) No…….....……

32. Name the type of solid wastes that can be re-used……...……

.....…….

33. What could be some of the human health effects resulting from poor solid waste?

---

34. What are the common diseases generated by poor solid waste mismanagement

---

Appendix 3: Observational Checklist

1. Is the waste left on the street and vacant land?

(1)Waste present…… ☐

(2)Waste not present…… ☐

2. Are there problems of water and soil pollution within the settlements due to waste related problem?

(1)No……..…… ☐

(2) Yes……...…… ☐

3. Are there insect and rodent infestation due to poor solid waste management?

If yes which one----------

-------4,The number of collection vehicles----------

5.The distance of dump site from the household----------

6.The distance of water source from the dumpsite----------

-

7.Type of solid waste container used----------

-------- ----------

Appendix 4: Fomu Ya Kushiriki Kwa Hiari

Jina langu ni Priscilla Gathigia Njogu, mwanafunzi wa shahada ya uzamili katika chuo kikuu cha Jomo Kenyatta katika shule ya Sayansi ya Afya. Mimi ndiye mtafiti mkuu katika utafiti huu.

Lengo la utafiti

Lengo la utafiti huu ni kutathmini namna mbinu za uzoaji na utupaji taka zinatekelezwa na wakaazi wa eneo la Gitothua.

Utaratibu wa utafiti

Mtafiti mkuu atawapa wakaazi wa Gitothua watakaokubali kushiriki hojaji. Mtafiti mkuu anaomba mshiriki kutupa idhini yake kwa kutia sahihi fomu hii ya kushiriki kwa hiari.

Faida ya utafiti

Hakutakuwa na faida za moja kwa moja kutokana na kushiriki kwako katika utafiti huu. Hata hivyo itanisaidia kupata habari zitakazosaidia kutambua mbinu zitakazotumika kuimarisha uzoaji taka katika manispaa ya Ruiru.

Hatari

Hamna hatari yoyote kwa atakayeshiriki katika utafiti huu.

Usiri.

Habari zote zitawekwa kuwa siri. Hakuna majina yatakayotumiwa waziwazi na kushiriki kwako kutakuwa kwa hiari. Mshiriki anaweza kuamua kukwamiza kushiriki kwake katika utafiti huu bila kuadhibiwa kwa njia yoyote.

Mawasiliano

Kwa maswali, maoni au malalamishi yanayohusiana na utafiti huu, basi wasiliana na mtafiti mkuu kupitia kwa nambari ya simu +254-0710711737 au kwabarua pepe: gathigianjogu@gmail.com

Tafadhali hakikisha kuwa umeelewa yote yanayohitajika ili uweze kushiriki kwenye utafiti huu na majukumu yako kama mhojiwa yawe yamefafanuliwa vizuri kwako.

TAARIFA YA MSHIRIKI.

Mimi----------nimekubali---------- kwamba nitashiriki katika utafiti huu wakutathmini namna mbinu za uzoaji na utupaji taka zinatekelezwa na wakaazi wa eneo la Gitothua kwenye manispaa ya Ruiru jimboni Kiambu.

Sahihi ya mshiriki----------

Appendix 5: Hojaji

1. Jinsia

(1) Mume…… ☐

(2) Mke.....……..……. ☐

2. Umri

(1) Kati ya miaka18-23……. ☐

(2) Kati ya miaka 24-29……..... ☐

(3) Kati ya miaka 30-35……...……. ☐

(3) Zaidi ya miaka 36……..……. ☐

(3. Kiwango cha elimu ☐

(1) Masomo yasiyo ya shule.....

(2) Shule ya msingi …… ☐

(3) Shule ya Sekondari…….. ☐

(4) Chuo …… ☐

4, Idadi ya watu katika familia

(1) Mtu mmoja…… ☐

(2) Watu watatu…….. ☐

(3) Zaidi ya watu watatu……..... ☐

(4) Wengineo (taja)……

5. Hali ya ndoa

(1) Nimeoa / Nimeolewa……. ☐

(2) Sijaoa/ Sijaolewa……. ☐

(3) Nimetalikiwa…… ☐

6. Kazi

(1) Mkulima…….....…. ☐

(2) Mfanyikazi wa serikali…… ☐

(3)Mfanyi biashara…… ☐

(4)Nyingineyo (taja)…….

7. Umekaa Ruiru kwa muda gani?

(1) Miezi mitatu……..…… ☐

(2) Miezi sita……. ☐

(3) Zaidi ya miezi sita ……..…….. ☐

(4)Muda mwingineo (Eleza)……

8. Neno taka lina maana gani kwako?

---

9. Je kuna shida ya uzoaji taka katika sehemu hii?

(1) Ndiyo…….....…….....……. ☐

(2) La…….....…….....…… ☐

10. Kwa maoni yako, je,shida hii ni kubwa?

(1) Kubwa zaidi…….....…… ☐

(2) Si kubwa sana…….....…….....…... ☐

(3) Sijui…….……. ☐

11. Ni aina gani ya taka ambayo hupatikana nyumbani kwako?

(1) Taka ya plastiki……..……..

(2) Masazo/mabaki ya chakula…….……..

(3) Taka ya vyuma…….…….

(4)Taka ya karatasi…….……...

(5) Yote yaliyotajwa hapo juu

(6) Taka Nyinginezo (Onyesha)…….

12. Wewe hutenganisha taka yako kabla ya kuhifadhi?

(1)Ndiyo…….....

(2) La…….…….

13. Je, una pipa la taka

(1)Ndiyo…….……...

(2) La…….……

14. Unatumia aina gani ya pipa?

(1) Ndoo…….…

(2) Mfuko wa karatasi…….……

(3) Gunia…….…….

(4) Pipa la chuma……..... ☐

(5) Aina nyingineyo (Eleza)……

15.Ni nani aliwapa pipa mnalotumia katika jengo au nyumba yenu?

(1) Nimejinunulia…….....……. ☐

(2)Serikali ya manispaa…….....……. ☐

(3) Kampuni ya kibinafsi….....……. ☐

(4) Wengineo Taja) ……..

16. Unatupa taka yako kutoka kwa pipa baada ya muda gani?

(1) Kila siku……. ☐

(2)Mara mbili kwa wiki…….....…… ☐

(3)Kila wiki…….....……..…….. ☐

(4) Nyakati nyinginezo taja…….....……

17. Unatupa taka ya pipa lako wapi?

(1) Ndani ya ploti…….....…. ☐

(2) Nje ya nyumba yangu……..... ☐

(3) Mahali palipo wazi……..... ☐

(4) Gari la kuzoa taka…….....

(5)Kwingineko (taja)……

18. Wewe huchukua muda gani kukusanya taka yako kabla ya kuitupa.

(1) Siku moja…….....……

(2)Mara mbili kwa siku…….....

(3) Baada ya wiki moja…….....

(4) Sijui…….....…….

(5) Mwingineo----------

19). Ni nani hukusanya taka kutoka nyumbani kwako?

(1) Kampuni ya kibinafsi…….....……...

(2) Serikali ya manispaa…….....……

(3)Mimi mwenyewe…….....…….

(4) Wengineo taja…….

20. Unaweza kuwataja wazoa taka vipi?

(1) Wazuri sana…….....…….

(2) Wazuri…….....……

(3) Wabaya…….....……... ☐

(4) Wabaya sana……...…….. ☐

21. Unatupa taka yako kwa njia gani?

(1)Mahali wazi…….....……..... ☐

(2) Ninachoma……..... ☐

(3)Ninatupa kwa pipa la taka……..... ☐

(4)Kwingineko (Taja)……..

22. Ni nani husafirisha taka yako hadi mahali pa kutupa taka.

(1) Watu wa jamii yangu……..……... ☐

(2) Kampuni ya kibinafsi……..... ☐

(3)Serikali ya manispaa…….....……...……... ☐

(4)Wengineo….....…….....…… ☐

23. Taka yako husafirishwa kwa njia gani?

(1) Kwa kutumia mkokoteni…….....……... ☐

(2)Gari la Kampuni…….....…… ☐

(3) Gari la serikali ya manispaa…….....…… ☐

(4)Njia nyingineyo……

24. Je, unalipia uzoaji wa taka?

(1) Ndiyo…….....……....……. ☐

(2) La…….....……...…… ☐

25. Ikiwa unalipia, ni mara ngapi kwamwezi,wiki,mwaka …….

26. Una maoni gani kwa huduma unayopata?

(1)

Nzuri……..... ☐

(2) ☐

Mbovu…….....…….……

(3) Maoni mengineyo----------

27. Je, unadhani taka hiyo inaweza kuwa na umuhimu wowote?

☐

(1)Ndiyo…….....……..…… ☐

(2) La…….....……

Ikiwa ni ndiyo je, ina umuhimu gani?.....

28) Je, wewe hutumia tena aina fulani za taka kwa matumizi mengine?

(1)Ndiyo…….....☐

(2) La…….....……..

☐

29) Taja aina ya taka zinazoweza kutumika tena kwa matumizi

mengine.....…….

---

30. Je, kuna athari zozote za kimazingira ambazo hutokana na uzoaji mbovu wa taka

Taja……..

31. Ni madhara gani ya afya ya mwanadamu yanayoweza kutokana na uzoaji mbaya wa

taka?

…….....…….....

…….....

32. Je ni magonjwa yapi ya kawaida katika eneo lako yanatokana na uzoaji mbaya wa taka?

Appendix 6: Logistic regression of demographic characteristics and solid waste management practices

Variable		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	**Upper**
Gender	Male	1.61	0.518	9.649	1	**0.002**	5.004	1.812	13.82
	Female	1.72	0.631	11.23					
Age	18-23 years			16.64	3	**0.001**			
	24-29 years	0.654	1.068	0.374	1	0.541	1.922	0.237	15.595
	30-35 years	-0.154	0.839	0.034	1	0.855	0.857	0.166	4.44
	36 years and above	2.653	0.896	8.769	1	**0.003**	14.192	2.452	82.139
Level of Education	Informal Education			0.142	3	0.986			
	Primary	-21.028	9593.81	0	1	0.998	0	0	.
	Secondary	-20.69	7794.89	0	1	0.998	0	0	.
	Tertiary Education	-0.166	0.441	0.142	1	0.706	0.847	0.357	2.01
Family Size	One			31.992	2	**0.000**			
	Three	4.086	0.736	30.835	1	**0.000**	59.527	14.071	251.833
	Three and above	1.815	0.567	10.234	1	**0.001**	6.139	2.019	18.66
Marital Status	Married			1.245	2	0.537			
	Single	22.182	5620.42	0	1	0.997	4.3E+09	0	.
	Divorced	22.803	5620.42	0	1	0.997	8E+09	0	.
Occupation	Farmer			7.249	3	0.064			
	Civil Servant	-36.945	16193.7	0	1	0.998	0	0	.
	Business	-16.934	14210.4	0	1	0.999	0	0	.
	Others	-18.882	14210.4	0	1	0.999	0	0	.
	Constant	-9.329	15281.5	0	1	1	0		