EFFECTS OF SOLID WASTE MANAGEMENT PRACTICES ON THE LOCAL PEOPLE'S GENENAL HEALTH:
A CASE STUDY OF MAKINDYE DIVISION, KAMPALA UGANDA.

BY

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DECLARATION

I WIRE NICHOLAS hereby declare that the content embodied in this research report, with exception of the acknowledged references, citation, and ideas are entirely my original work as compiled from the study carried out in Makindye division, and has never been submitted for the award of a Master's Degree in any institution.

WIRE NICHOLAS

Sign……

Date……..

APPROVAL

This is to certify that this research report has been submitted for examination with my approval as a University supervisor.

Sign…… Date: ……

DR. BARAKAGIRA ALEX

Supervisor

DEDICATION

This research report is dedicated to my beloved Daddy Mr. Mugaba Raymond, who raised and educated me and has continuously supported me throughout this stage in life. I will always be grateful to my beloved mum, Wabwire Betty for all the encouragement and support she has always given me. Thanks to my brothers and sisters for standing with me. With great love, honor and respect I dedicate this research to my darling wife Nalwoga Teddy and my beloved daughters. I thank you for your patience, perseverance through the hard times of financial crisis caused to achieve this great success of my study. To my friends, all for the encouragement, care and love. May the almighty God bless and take care of you.

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Lastly, I would like to thank my colleagues, the Master of Science Environmental Health class, for the valuable contribution, support and team spirit they exhibited throughout the course. Thank you.

LIST OF ABBREVIATIONS AND ACRONYMS

KCCA	-	Kampala City Council Authority
MSW	-	Municipal Solid Waste
MSWM	-	Municipal Solid Waste Management
NEMA	-	National Environmental Management Authority
NWSC	-	National Water and Sewage Corporation
NGO	-	Non-Governmental Organizations
PAH	-	Polycyclic Aromatic Hydrocarbon
PCB	-	Polychlorinated Bi Phenyls
RDF	-	Refuse Derived Fuel
SCOS	-	School of sciences
SW	-	Solid waste
SWM	-	Solid Waste Management
UN	-	United Nations
UNEP	-	United Nations Environmental Program
USEPA	-	United States Environmental Protection Association
VOC	-	Volatile Organic Compound

OPERATIONAL DEFINITION OF KEY TERMS

Discharge: The action of allowing water to flow out from where it had been contained.

Diseases: Is an abnormal condition affecting a living organism.

Drainage: Is the natural removal of surface water from an area.

Dumping: The disposal of waste in the sea or on land.

Effect: The result of a particular influence.

Environment: Is everything that is around us.

Environment education: Is an organized effort to educate people about the natural environment, and how to manage their behavior to live sustainably

Environmental health: Refers to the health implication of the interaction between individuals and their natural and built environment.

Environmental policy: Is the commitment of an organization to the laws, regulations, and other policy mechanisms concerning environmental issues.

Environmental sanitation: Is intervention to reduce people's exposure to diseases by promoting a clean environment in which to live.

Hazardous waste: Is waste that poses substantial or potential threats to public health or the environment

Health: It is a condition of the body which makes the person not to perform actively

Hindrances: Is the state of being interfered with, held back, or slowed down

Household: A house and its occupants regarded as a unit.

Hospital waste: That is discarded by a hospital and notintended for further use.

Incineration: Is a waste treatment process that involves the combustion of organic substances contained in waste materials

Indiscriminate: Done at random or without careful judgment.

Industrial effluent: Solid waste from industrial premises excluding domestic solid waste.

Local communities: A group of individuals that interact within their immediate surroundings

Municipal solid waste: All types of solid waste generated by households and

commercial establishments.

Partnerships: Is a formal arrangement in which two or more parties cooperate to manage and operate.

Policy: Is a deliberate system of principles to guide decisions and achieve rational outcomes.

Pyrolysis: Is defined as thermal degradation of waste in the absence of air to produce char

Recycle: Is the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products

Reuse: To use again especially in a different way

Sanitation: General cleanliness of the environment to prevent occurrence of disease.

Sewer: Pipe or conduit carrying waste water.

Solid waste: Means any garbage or refuse, sludge from a wastewater treatment plant or water supply treatment plant.

Solid waste disposal: Proper disposition of a discarded or discharged material in accordance with local environmental guidelines or laws.

Solid waste management: refers to the process of collecting and treating solid wastes.

Stakeholders: A person, group or organization that has interest or concern in an organization.

Waste: Is any substance which is discarded after primary use, or is worthless, defective and of no use.

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ABSTRACT

The study was conducted to investigate the effects of solid waste management practices on the local people's general health in Makindye division, this study employed Across-sectional research design and case study which used both descriptive and analytical methods. The study focused on the nature of solid waste generated, practices employed in solid waste management and the hindrances faced by Makindye Division in managing the solid waste.

The objectives of the study were to identity the types of solid waste generated, to examine the present solid waste management practices, to establish factors hindering effective solid waste management by Makindye Division and to find out diseases members of the local communities suffer from that are related to different SWM practices. The study used random sampling technique to determine a sample size of 393 respondents.

Mostly, qualitative data was obtained from questionnaires, observation schedules and interview guides which were coded, interpreted and entered into SPSS. Further data was analyzed to give it a broader and more meaningful picture of the sample in addition to generating frequency tables, pie charts and bar graphs for further interpretation.

The study findings revealed that paper and carton, yard trimmings, food scraps, wood glass, plastics, metal and clothes were the types of solid waste generated by Makindye Division

Field findings also indicated that Makindye Division employed various practices to control and minimize the solid waste generated which included; recycle, reuse, waste reduction, compositing, energy recovery, compaction, dumping, incineration, pyrolysis and partnerships in solid waste management.

Study findings reported that Makindye Division bottleneck in its solid waste management include KCCA's failure to collect the waste on time, insufficient capital, weather vagaries, nature and composition of the waste, limited space and collection containers.

It was recommended that Makindye Division improves employment conditions as well as access to support services. Markets of recycling industries need to participate in waste management by separating their waste at source point. build broad-based support for composting and recycling through the ''garbage is money'' poster campaign, KCCA need to have a deliberate policy that encourages the community and various stakeholders to play a role in developing garbage-related policies, environmental education to the communities should be taken seriously authorities to work with private companies in providing services to the people, links should be established between recycling companies and communities groups and an effective environmental policy among the poor needs to have an element of economic incentive for them to be supportive. There is need to develop a policy that involves the community in waste management.

CHAPTER ONE

1.1 Introduction

This chapter presents the background, the statement of the problem, objectives, research questions, scope of the study and conceptual framework. The study aimed at knowing effects of Solid Waste Management (SWM) practices on People's general health.

1.2 Background to the study

Human activities have always generated waste. This was not a major issue when the human population was relatively small and nomadic, but became a serious problem with urbanization and the growth of large conurbations. Poor management of waste led to contamination of water, soil and atmosphere and to a major impact on public health. In medieval times, epidemics associated with water contaminated with pathogens decimated the population of Europe and even more recently (19th century), cholera was a common occurrence. Some of the direct health impacts of the mismanagement of waste are well known and can be observed especially in developing countries. Solid waste management (SWM) is a topic of universal concern for rural and urban areas in the developed and developing countries. Historically, countries dealt with waste by burying it, letting animals eat it and forgetting about it. This approach is no longer sustainable (Joseph, 2006).

Many developing countries are experiencing problems caused by inappropriate and inefficient SWM, and often short term solutions like uncontrolled dumping is practiced. The need for SWM plans is widely recognized, but may not be feasible due to lack of funds or insufficient institutional capacity (Abrelpe, 2012). The pressure on SWM operations caused by a more interconnected global economy is growing due to increasing generation and complexity of waste. In a global perspective this can lead countries to unsound SWM practices and disposal operations. If waste is not managed in a sustainable way, meaning long-term solutions founded in local communities, the connected costs may grow to such an extent that the economy and public services fail to keep up (Barra, Portas, and Watkinson, 2012). Such a scenario is seen in many places in the world already, and especially in developing countries.

Waste is increasingly viewed as an imperative issue worldwide, although the residential challenges and impacts of general solid waste do not seem to have the highest priority. This may partly be due to the newer issues of e-waste and chemical waste that present immediate problems, while general solid waste is a well known issue with few challenges, except continual growth. UN´s GEO5 deal with waste. Chemicals and Waste, mainly concerning how hazardous wastes are mixed with solid wastes. The mixed waste is either dumped or burned in the open, raising issues of environmental and social justice, as "the people most affected by these dangerous practices are usually the poor who live and work close to dump sites" (Barra *et al,*2012). Although chemicals are a threat to health and livelihoods when mixed with solid waste, the focus on "ordinary" household waste and its management is not prioritized in the GEO5 report.

Municipal waste constitutes a significant percentage of the total waste a country generates

(OECD, 2008), with annual figures ranging from 0.4 to 0.8 tonnes per person, and solid waste generation increasing at an estimated rate of about 0.5–0.7 per cent per year. In addition, the sound management of municipal waste continues to be a sizable and continuously growing part of a municipality's budget (Barra *et al,* 2012). In developing countries the cost of waste collection, disposal and treatment would be between 0.7- 2.6 % of income/capita/year, while in comparison the same numbers for high income countries are 0.2-0.5%.

In 2012, world cities generated approximately 1.3 billion tonnes of solid waste per year, with an expected increase of 2.2 billion tonnes by 2025. In lower income countries waste generation will more than double in the next twenty years, in a business as usual scenario. Solid waste management costs will almost double globally, to around $375.5 billion in 2025 (Cointreau, 2006).

A number of serious and highly publicized pollution incidents associated with incorrect waste management practices, led to public concern about lack of controls, inadequate legislation, environmental and human health impact. This in turn forced many governments to introduce new regulatory frameworks to deal with hazardous and unsustainable waste management operations. A waste management hierarchy based on

the most environmentally sound criteria favors waste prevention/minimization, waste re-use, recycling, and composting. In many countries, a large percentage of waste cannot presently be re-used, re-cycled or composted and the main disposal methods are land filling and incineration. In Europe, land filling is the main disposal method. In 1999, 57% of MSW was land filled (67% in 1995) in Western Europe, and 83.7% (Barra *et al* 2012).

Implementing a solid waste reduction program in a city can create significant cost savings in waste hauling fees while creating a more environmentally friendly division. This is especially true as solid waste becomes a more significant environmental issue and landfill fees increase. Often division hesitates to establish programs in solid waste management because of the coordination and cooperation needed among management, employees, and guests. However, the cost benefit is an incentive (Zurbrugg, 2009).

The West in San Francisco implemented their recycling program in 1994. The practices such waste-reducing steps as purchasing recycled content products, providing environmental education to their employees, donating their excess food to local food banks, and recycling paper, aluminum, and plastics (USEPA, 2002). It has been recognized for its waste reducing efforts, and it participates in organizations with others who share an interest in green practices. The hotel is a member of the Recycled Paper Coalition and the Sustainable San Mateo County Business Council, and received an award from the Waste Reduction Award Program in 2000. Annually, they recycle 22 tons of materials and save $6,000.

Another aspect of a solid waste reduction program is dealing with food waste, which can frequently be a large portion of the waste produced in residential, hotels and lodging facilities. Over preparation, table scraps, cooking losses, and packaging failures lead to accumulation of food waste. Because spoiled food and even leftover plate scrapings can be composted, communities are increasingly recognizing that composting is a better use of organic materials than trucking them to landfills (USEPA, 2002).

In most developing countries, typically one to two thirds of the solid waste generated is not collected (Zerbock, 2006). As a result, the uncollected waste, which is often also mixed with human and animal excreta, is dumped indiscriminately in the streets and in drains, contributing to flooding, breeding of insect and rodent vectors and the spread of diseases such as cholera.

Solid waste management encompasses generation, collection, transportation and disposal of urban waste. Urban authorities have the responsibility to ensure safe, reliable and cost effective removal and disposal of solid waste, which takes up a large proportion of available resources which are not adequate to cope with the magnitude of the problem (NEMA, 2010).

Unfortunately, public agents, and urban authorities do not have adequate capacity to handle the increased solid waste mainly due to limited public budgets. A consequence of failure to remove solid waste finally is health hazards like tetanus, water and sanitary as well as environmental problems such as contamination and pollution in Uganda especially in urban centers (NEMA, 2012).

To this end this study was undertaken with a focus on solid waste management in Kampala Makindye Division. The study was carried out from December to September 2018.

1.3 Statement of the problem

According to a report (KCCA, 2011) Uganda is facing rapid urbanization of 5.1% per annum, leading to overcrowding and the development of slums and informal settlements with poor waste management practices? Urban dwellers generally consume more resources than rural dwellers, and so generate large quantities of solid waste. Waste management in these areas is hampered by multiple land tenure system with many tenants not having a right to the land and therefore not able to manage waste domestically and also the urban authorities are overwhelmed by the sheer volumes of garbage generated. Solid Waste (SW) collection is currently one of the most critical services, whose quality and coverage has caused serious public outcry in slum areas. Kampala Capital City Authority acknowledges that the amount of Solid waste generated overwhelms the capacity of the Authority to collect and dispose it given the fact that the

cost of SW collection is enormous. Out of 1,200–1,500 tons of garbage generated per day, only 400-500 tones are collected giving a collection efficiency of only 40%. This implies that 60% of Solid waste generated daily is not properly collected and disposed which is likely to be indiscriminately dissolved and results into negative effects towards people's general health like unsafe ground water and disease such as cholera among others .The information about the effects of SWM practices on the local people's general health is scanty of which this study intends to determine.

1.4. Objectives

1.4.1 General objective

The general objective of the study was to establish eeffects of solid waste management practices on the local people's general health in Kampala Makindye Division.

1.4.2 Specific Objectives

i) To determine the types of solid waste disposed in Makindye Division

ii) To find out different ways of solid waste management practices in Makindye Division

iii) To establish the factors that are hindering effective solid waste management in Makindye Division

iv) To establish diseases members of the local community suffer that are related to different SWM practices

1.5 Research Questions

a) What are the types of solid wastes generated in Makindye division?

b) What are the present solid waste management practices in Makindye division?

c) What are the hindering factors to solid waste management in Makindye division?

d)What are the likely diseases caused by poor solid waste management on people's general health**?**

1.6 Justification of the study

Effects of solid waste management practices on the local people's general health in Makindye Division has become a matter of great concern that needs to be addressed. Valuable resources are likely to be spent unnecessary on remediation measures unless this issue is addressed effectively and sustainably first by involving the communities, knowledge and attitude about solid waste management practices since there is hardly any research or documents at the division. Therefore, it was important for this study to be conducted because it has been one of the key ingredients towards achieving proper solid waste management practices. Carrying out the study is also in fulfillment of the requirement of the award of a Master's degree in environmental health of Nkumba University

1.7 Significance of the study

The findings of the study will contribute to the body of knowledge about effects of solid waste management practices on the local people's general health in Makindye Division. Little has been documented about solid waste management practices in the documentary sources at the Division .Therefore the study will reveal and document information upon which policy makers, Makindye public and environmental health staff and other stakeholders can use to develop plans and action to improve and develop sustainable approaches of managing solid waste disposal. The mass media and other bodies charged with awareness creation will also benefit from the study.

1.8 Purpose of the Study

It is hoped that the findings of this study will help to raise awareness on issues pertaining to waste management, this awareness will help to build initiatives to reduce the problem. This research highlighted the role of the different stakeholders and the extent to which they have been active in addressing the waste management problem.

Partners in development could use this information by identifying specific solid waste practices, thus making a sound environment and eradication of diseases related to poor solid waste management in the country. For those that are engaged in there is opportunity to generate income by helping the communities get rid of the solid waste hence profiting for garbage. Seemly urban authorities may also make use of the findings of this study

helpful in their solid waste management planning strategies.

1.9 Scope of the Study

1.9.1 Content

The study highlighted the effectiveness of the current waste management practices. As a result the necessary remedies were recommended. The study drew lessons from best practices elsewhere and suggested ways of adopting them. This study helped to identify the bottlenecks of waste management, so that remedies may be evolved. The study confirmed only on solid waste management practices at Makindye Division and 393 respondents were selected.

1.9.2 Geographical

The study confined only on solid waste management practices at Makindye Division and 393 respondents were selected.

1.9.3 Time frame

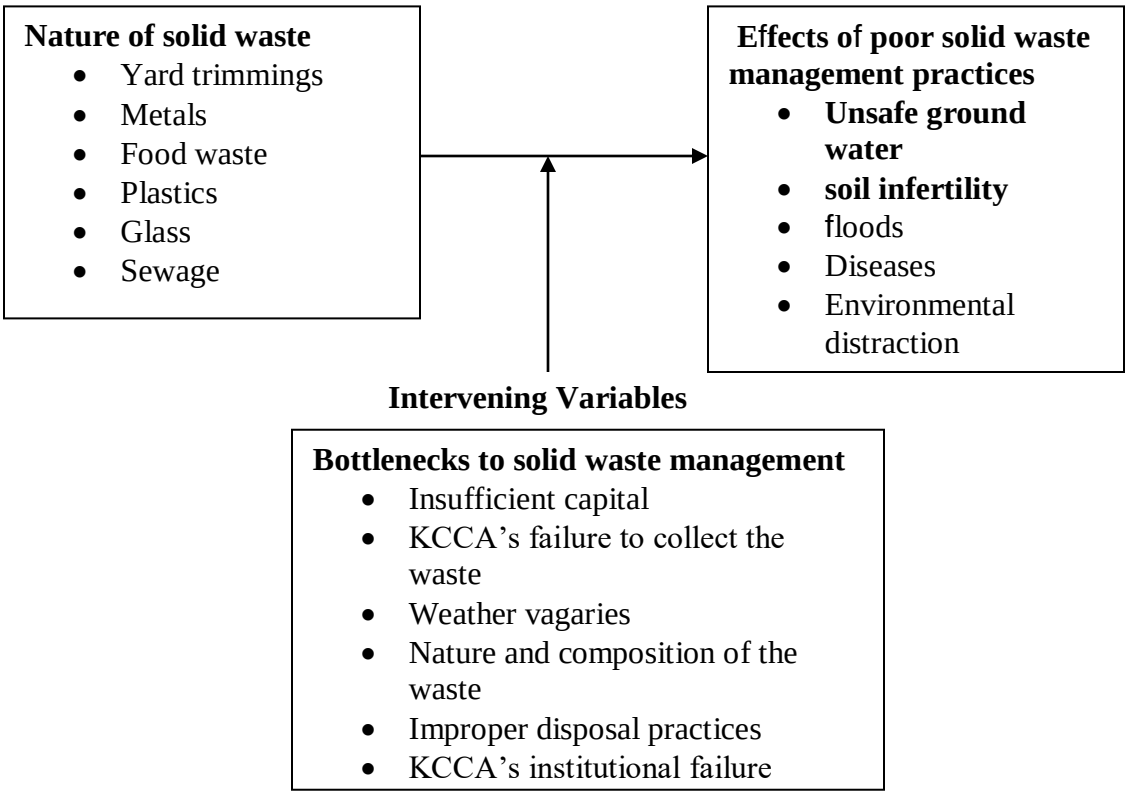
A total of thirty six days were spent collecting data using mainly participatory method. Along this, questionnaires were also administered on 393 respondents from around, Makindye Division and it was carried out from December 2017 to August 2018.

1.10 Assumptions

1. Division devised alternatives practices for solid waste management which are sustainable as compared to practices generated from the community.
2. Increasing stakeholders' awareness of the gravity of solid waste management crisis will exert pressure on all stakeholders to work out a realistic and practical approach to the problem.

1.11 Conceptual Frame work

Independent variables **Dependent variables**



Developed by the researcher, 2017

Figure 1: The conceptual frame work

Explanation of the conceptual framework

According to figure 1 , Kampala generates yard trimmings, metals, plastics, food scrap, glass, sewage, wood, paper and carton and textile/ clothing as its nature of solid waste (Independent variables). This nature of the solid waste generated determines the kind of effects on people's livelihood (dependent variables). However ,Kampala faces many bottlenecks in managing its solid waste such as KCCA's failure to collect the waste on time, insufficient capital, weather vagaries, nature and composition of the waste, limited space and dust bins/ collection containers respectively (intervening variables).

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Waste is most often defined as unwanted leftover or excess materials that are discarded and needs to be handled in a specific manner to avoid negative impacts like floods and diseases, Solid waste may be in the form of household garbage, leftovers of food and other wastage that include papers or plastic waste among others (Larry, 2009).

The management of solid waste is one of the challenges facing the health sector in the world. The emergence of solid waste can be dated back to the beginning of human civilization, when early man began to consume animal products and generated garbage in the form of bones and other parts of animals they used to slaughter. With the advancements in the human cycle of growth more and more products came into existence that included wood, metals and other items and the waste generated became more complex in nature. Hence an aggregation of human settlements with the potential to produce a large amount of solid waste; the collection, transfer and disposal of that waste has been generally assumed by municipality's authorities in the developed world (Zerbock, 2009).

2.1 Types of solid waste

Kampala generates an estimated 31.423 tons of garbage daily with a composition of Biodegradable (76%), Plastics (4%), Metal (3%), Polythene (8%) and others (9%) (KCCA, 2011). The average per capita solid waste generation rate is 1.284-kg/per person/per day with a high organic content and bulky density. However there were varying per capita generation rates depending on income levels with high-income households generating more wastes than low income households .Accumulation is higher in low income areas compared to high income settlements due to unavailability of waste collection services (KCCA, 2011).

In most developing countries Uganda inclusive, solid waste management problems differ from those found in fully industrialized countries; indeed, the very composition of their waste is different from that of 'developed' nations. In developing countries' solid waste

generation rates average only 0.4 to 0.6 kg/person/day, as opposed to 0.7 to 1.8 kg/person/day in fully industrialized countries. UNEP (2006) noted several common differences in the composition of solid waste in developing nations. Before one can examine individual problems in solid waste management practices, it is important to understand the political and economic framework in which governments must frequently work in developing countries. However the researcher studied the different types of solid waste.

2.1.1 Municipal solid waste

Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial complexes (Kinman *et al,* 1992). With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly and its composition changing.

According to Kinman *et al*, 1992 cities and towns in India generated an estimated 6 million tone of solid waste; in 1997 it was about 48 million tones. More than 25% of the municipal solid waste is not collected at all. It is also reported that 70% of the Indian cities lack adequate capacity to transport it and there are no sanitary landfills to dispose of the waste. The existing landfills are neither well equipped nor well managed and are not lined properly to prevent contamination of soil and groundwater. Over the last few years, the consumer market has grown rapidly leading to products being packed in cans, aluminum foils, plastics, and other such non-biodegradable items that cause incalculable harm to the environment.

In India, some municipal areas have banned the use of plastics and they seem to have achieved success. For example, today one will not see a single piece of plastic in the entire district of Ladakh where the local authorities imposed a ban on plastics in 1998. One positive note is that in many large cities, shops have begun packing items in reusable or biodegradable bags. Certain biodegradable items can also be composted and reused (Rickabaugh, 1999). In fact proper handling of the biodegradable waste will considerably lessen the burden of solid waste that each city has to tackle.

2.1.2 Hazardous waste

This type of waste is a waste that is quite dangerous as it consists of toxic substances that are of chemical nature. This type of waste is highly dangerous to human, plants, animals and the overall environment

Industrial and hospital waste is considered hazardous as they may contain also toxic substances. Certain types of household waste are also hazardous like batteries, pesticide and solvents. Hazardous wastes could be highly corrosive, highly inflammable or explosive, and react when exposed to certain things like gases. As improper disposal of the industrial solid waste may lead to death, disease and sometimes an environmental damage may continue for generations. For example: any oil spill in the seas, oceans or release of poison gases, chemicals in the air and improper disposal of industrial effluents into the soil will lead to destruction of all living species in addition to environmental damage (Pradesh *et al,* 1999).

Hospital waste contaminated by chemicals used in hospitals is considered hazardous. These chemicals include formaldehyde and phenols, which are used as disinfectants and mercury which is used in thermometers or equipment that measure blood pressure. Most hospitals in developing countries like Uganda do not have proper disposal facilities for these hazardous wastes hence affecting the peoples' general health. In the industrial sector, the major generators of hazardous waste are the metal, chemical, paper, pesticide, dye, refining, and rubber goods industries (Busha and Harter 1998).

2.1.3 Hospital waste or Biomedical waste

The other form of solid waste is the Hospital waste that is being generated day in day out by various hospitals, clinics, research centers, pharmaceutical companies and health care centers. This type of solid waste is most infectious and can spread diseases and other types of viral and bacterial infections among humans and animals if not managed properly in a scientific way. The hospital waste includes solid waste in the form of disposable syringes, bandages, cotton swabs, body fluids, human excreta, anatomical waste, bandages, expired medicines, and other types of chemical and biological waste. Hospital waste is equally hazardous and dangerous as in case of industrial waste if not disposed off or managed in a scientific and discriminate manner. It has been roughly

estimated that of the 4 kg of waste generated in a hospital at least 1 kg would be infected (UNEP, 2006).

Surveys carried out by various agencies show that the health care establishments in India are not giving due attention to their waste management. After the notification of the Bio-medical Waste these establishments are slowly streamlining the process of waste segregation, collection, treatment, and disposal. Many of the larger hospitals have either installed the treatment facilities or are in the process of doing so (Handling and Management Rules, 1998).

2.2 Solid Waste Management Practices

Solid waste management practices employed in Kampala include waste reduction, dumping, recycling, reuse, compositing and incineration /burning.

However, recycling and garbage reuse of inorganic materials from solid waste was not well developed by informal sector and such activities were seldom unrecognized, supported, or promoted by the urban authority as one of the approaches to support garbage management in the area despite having the advantage of: reducing costs of the disposal facilities, prolonging the site span, and also reducing the environmental impact of disposal sites as the organics are largely to blame for the polluting leaches and methane problems (UNEP, 2006).

2.2.1 Waste Reduction

Waste reduction is a practice intended to reduce the amount of waste produced. By reducing or eliminating the generation of harmful and persistent wastes, waste reduction supports efforts to promote a more sustainable society. Waste reduction involves redesigning products, repairing and processes or changing societal patterns of consumption and production (USEPA 2002).

The most environmentally resourceful, economically efficient, and cost effective way to manage waste often is to not have to address the problem in the first place. Managers see waste reduction as a primary focus for most waste management practices. Proper waste treatment and disposal can require a significant amount of time and resources; therefore,

the benefits of waste reduction can be considerable if carried out in an effective, safe and sustainable manner.

Traditional waste management focuses on processing waste after it is created, concentrating on re-use, recycling, and waste_to_energy conversion. Waste reduction involves efforts to avoid creating the waste during manufacture. To effectively implement waste reduction the manager/communities requires knowledge of the production process, cradle-to-grave analysis (the tracking of materials from their extraction to their return to earth) and details of the composition of the waste.

The main sources of waste vary from country to country. In the United Kingdom, most waste comes from the construction and demolition of buildings, followed by mining and quarrying, industry and commerce. Household waste constitutes a relatively small proportion of all waste. Industrial waste is often tied to requirements in the supply chain. For example, a company handling a product may insist that it should be shipped using particular packing because it fits downstream needs.

2.2.2 Reuse

Reuse is the process, which involves reusing items by repairing them, donating them to charity and community groups, or selling them. Reuse is using the same material more than once for the same function such as formwork in construction.

Reusing products is an alternative to recycling because the item does not need to be reprocessed for its use again. Using durable glassware, still using cloth napkins or towels, reusing bottles, reusing boxes, purchasing refillable pens and pencils are suggested(Zerbock, 2006).

Reuse is usually a favorite option because some construction waste can be reused in other construction project. Reuse is most beneficial and contractors can save money since disposal involves cost (Taylor, 1999).

2.2.3 Waste- to- energy

Waste to energy refers to a technology that treats waste to recover energy in the form of heat, electricity or alternative fuels such as biogas from the solid waste UNEP (1996). The scope of the term ‘Waste-to-Energy’ is very wide, encompassing a range of technologies of different scales and complexity. These can include the production of

cooking gas in household digesters from organic waste, collection of methane gas from landfills, thermal treatment of waste in utility size incineration plants, co-processing of Refuse Derived Fuel (RDF) in cement plants or gasification. This research takes a very broad understanding of Waste to energy, referring to large scale plants at the municipal level using the technologies of incineration, co-processing, anaerobic digestion, landfill gas collection and pyrolysis/gasification. These five technologies apply to different waste streams and have different functions and characteristics. Their applicability must therefore be assessed independently based on the local context and waste stream discussed USEPA (2002).

Growing concerns regarding shrinking natural resources, contribution of improper waste management to global warming and shortage of power generation have triggered discussions regarding waste as a resource in general and Waste to Energy concepts in particular. Decision makers at national and local level in developing and emerging countries may be tempted by technology providers who promise that Waste to Energy plants will solve their waste disposal problems, create a lucrative business opportunity and contribute positively to energy supply. As such, waste seems to be an ideal feedstock for energy recovery. So far however, some projects built in developing and emerging countries have operated successfully in the long term (Senkoro, 2009; Schiibeler, 2006).

Some positive experiences so far lie in state-of-the-art co-processing in cement kilns and landfill gas collection applied to sanitary landfills. However to date, there are many anaerobic digesters fed with segregated organic MSW in successful operation on a large scale in developing countries, more than a handful of waste incinerators in continuous operation in developing countries in Africa and Asia (Humphrey and Water, 2001).

2.2.4 Compaction

Waste compaction is the process of compacting waste, reducing it in size. Compaction is a volume reduction process in which solid materials are mechanically compressed to achieve smaller volumes. It is an economical technique due to moderate capital cost and low operation and maintenance cost. There is no multiple handling of the waste. Generation of air-borne activity is also minimal; hence radiation exposure during operation is very low. Criteria that might be applied in the selection of treatment processes for compactable wastes could include the economics of the processes, the

desirability of volume reduction, the complexity of the technology and equipment, the regulatory requirements and the future options for interim storage or disposal (Humphrey and Water, 2001).

Compaction is one of the most important stages of the storage process in landfills. Well-compacted municipal solid waste (MSW) occupies less volume than an compacted MSW sample of the same weight and provides a safer storage area. With respect to the composition effect, the percentage of organic waste is the most important factor on the compaction behavior of MSWs. As paper, organic and plastic contents increase in the MSW composition the value decreases and increases (Humphrey and Water, 2001).

COMPACTING BENEFITS

Proper technique for solid waste compaction consists of shredding the waste into small pieces, pushing it to mix it, placing it to fill voids and finally, compacting it to maximize the tonnage of waste using a minimum of space in the landfill.

The more compaction, the less infiltration of rain water inside the cell. Water remains close to the surface, and a higher percent evaporates instead of percolating through the landfill. This reduces the amount of leachate generated, reduces ground pollution risks and lowers leachate treatment costs.

Risks of uneven settlement and landslides are reduced once waste has been compacted. Landslides on a landfill generally start from the slopes of a landfill cell. These areas are more likely to receive less compaction and cover during cell development. However, they are critical areas where good compaction and surface stabilization must be achieved. Good compaction also provides a base for access roads for collection trucks during landfill operation (Adiodum. D, 2001).

2.2.5 Pyrolysis

Pyrolysis is defined as thermal degradation of waste in the absence of air to produce char, pyrolysis oil and syngas. External source of heat is employed in this process (UNEP, 1996). Because most organic substances are thermally unstable they can upon heating in an oxygen-free atmosphere be split through a combination of thermal cracking and

condensation reactions into gaseous, liquid and solid fraction. Pyrolysis process consists of both simultaneous and successive reactions when carbon-rich organic material is heated in a non-reactive atmosphere. Thermal decomposition of organic components in the waste stream starts at 350°C–550°C and goes up to 700°C–800°C in the absence of air/oxygen (UNEP, 1996).

Pyrolysis of municipal wastes begins with mechanical preparation and separation of glass, metals and inert materials prior to processing the remaining waste in a pyrolysis reactor. The commonly used pyrolysis reactors are rotary kilns, rotary hearth furnaces, and fluidized bed furnaces. The process requires an external heat source to maintain the high temperature required. Pyrolysis can be performed at relatively small-scale which may help in reducing transport and handling costs. The main products obtained from pyrolysis of municipal wastes are a high calorific value gas (synthesis gas or syngas), a biofuel (bio oil or pyrolysis oil) and a solid residue (char). Depending on the final temperature, MSW pyrolysis will yield mainly solid residues at low temperatures, less than 450^0C, when the heating rate is quite slow, and mainly gases at high temperatures, greater than 800^0C, with rapid heating rates. At an intermediate temperature and under relatively high heating rates, the main product is a liquid fuel popularly known as bio oil (Salman, 2016.)

2.2.6 Recycling

Rand *et al*, (2000) notes that one of the approaches to waste management is by separating or sorting waste generated and eventually using it for other form of production. Separating waste materials at the household level occurs to some extent almost universally, and prevents the most valuable and reusable materials from being discarded. Following in-home retention of valuable material, waste-pickers currently remove most valuable materials either before garbage enters the waste stream or en route, especially in the lower and middle-income areas of many municipalities. In Uganda sorting of waste has not been successful for unclear reasons (UNEP, 2006).

Companies could help to divert many materials out of the waste stream. Since recycling materials is a financially viable undertaking, small enterprises have and will continue to spring up whenever there is an opportunity. In fact the theft of source separated

recyclable materials has been documented in many pilot schemes in both developed and developing nations (UNEP, 2006). Municipalities should not only recognize the trade in recyclables, they should embrace it. By allowing small enterprise to address the problem, valuable funds are saved, jobs are created and landfill space is saved. Perhaps through micro-loans or some small-scale assistance, local governments could support and legitimize these entrepreneurs.

Johannessen (2009) asserts that recycling inorganic materials from municipal solid waste is often well developed by the activities of the informal sector although such activities are seldom recognized, supported, or promoted by the municipal authorities. Some key factors that affect the potential for resource recovery are the cost of the separated material, its purity, its quantity and its location. The costs .of storage and transport are major factors that decide the economic potential for resource recovery. In many low-income countries, the fraction of material that is won for resource recovery is very high, because this work is done in a very labour-intensive way, and for very low incomes. Recycling has the advantage of reducing costs of the disposal facilities, prolonging the site span.

2.2.7Composting

A somewhat more low-technology approach to waste management is composting. The waste of many developing nations would theoretically be ideal for reduction through composting, having a much higher composition of organic material than industrialized countries. For example, generally, in developing countries, the average city's municipal waste stream is over 50% organic material (Hoornweg *et al*., 2002). Studies in Bandung, Indonesia and Colombo, Sri Lanka have revealed that residential waste composed of 78% and 81% compostable material, and market waste 89% and 90% compostable, respectively. However, composting has not been overwhelmingly successful and widespread in practice throughout the developing world. Although well documented in China and other areas of eastern Asia, composting projects have had a spotty record throughout Africa, Latin America and elsewhere, and have had the largest number of failed facilities worldwide (UNEP, 2006).

There are many advantages to composting. First and foremost, it would reduce, in some cases significantly, the amount of waste requiring ultimate disposal, extending the life of landfills. When done correctly, the end result becomes a useful product, capable of being used at the household or farm level to augment soil nutrient levels and increase organic matter in the soil, increasing soil stability. If the product is of high enough quality and markets exist, the product can be sold. Environmentally, the process by which composting decomposes organic waste is preferable to landfill processes. In a landfill, bacteria break down organics anaerobically in the absence of oxygen, resulting in the releases of methane gas which may be used for home actives. When properly composted, however, the organic matter is decomposed using an aerobic process, which produces no methane by-product (Mugisha, 2010).

2.2.8 Energy recovery

Energy recovery from waste is the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, anaerobic digestion and landfill gas recovery. This process is often called waste-to-energy. Energy recovery from waste is part of the non-hazardous waste management hierarchy. Using energy recovery to convert non-recyclable waste materials into electricity and heat, generates a renewable energy source and can reduce carbon emissions by offsetting the need for energy from fossil sources as well as reduce methane generation from landfills. Globally, waste-to-energy accounts for 16% of waste management (UNEP, 2006).

The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Thermal treatment ranges from using waste as a fuel source for cooking or heating and the use of the gas fuel, fuel for boilers to generate steam and electricity in a turbine. Gasification is another related form of thermal treatment where waste materials are heated to high temperatures with limited oxygen availability. The process usually occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other chemical products (chemical refinery). The solid residue (char) can be further

refined into products such as activated carbon. Gasification and advanced Plasma arc gasification are used to convert organic materials directly into a synthetic gas (syngas) composed of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam. An alternative to pyrolysis is high temperature and pressure supercritical water decomposition (hydrothermal monophasic oxidation) (Humphrey and water, 2001).

2.2.9 Reduce (Waste Prevention)

Waste prevention, or "source reduction," means consuming and discarding less, is a successful method of reducing waste generation. Backyard composting, double sided copying of papers, purchasing durable, long- lasting environmentally friendly goods; products and packaging that are free of toxics, redesigning products to use less raw material production and transport packaging reduction by industries are the normal practices used and have yielded substantial environmental benefits. Source reduction prevents emissions of many greenhouse gases, reduces pollutants, the need saves energy conserves resources, and reduces wastes for new landfills and combustors. It reduces the generation of waste and is generally preferred method of waste management that goes a long way toward saving the environment (Busha and Harter, 1998).

2.2.10 Dumping

The dumping of solid waste in landfills, is probably the oldest and definitely the most prevalent form of ultimate garbage disposal still mostly observed in developing countries. Many "landfills" are nothing more than open, sometimes controlled dumps. The difference between landfills and dumps is the level of engineering, planning, and administration involved. Open dumps are characterized by the lack of engineering measures, no leachate management, no consideration of landfill gas management. In an examination of landfills throughout the developing world in 2007-2008, there was varying amounts of planning and engineering in MSW dumping; among the various regions visited, African nations (with the exception of South Africa) had the fewest engineered landfills, with most nations practicing open dumping for waste disposal (Johannessen ,2009).

Where the waste is dumped in an uncontrolled manner, this can be detrimental to the urban environment. Many governments now acknowledge the dangers to the environment

and to public health derived from uncontrolled waste dumping. Financial and institutional constraints are one of the main reasons for inadequate disposal of waste, especially where local governments are weak or underfinanced and rapid population growth continues (Zurbrugg, 2003).

2.2.11 Incineration

Another option for waste management is incineration. Incineration should be considered a 'disposal' option, since following incineration there is still some quantity of ash to be disposed off (probably in a landfill), as well as the dispersal of some ash and constituent chemicals into the atmosphere. It should instead be considered more in terms of its decreasing potential, which can be 80-95% in terms of waste volume (Rand *et al*., 2000). Incineration is an inappropriate technology for most low-income countries like Uganda. Above all, the high financial start-up and operational capital required to implement incineration facilities is a major barrier to successful adoption in developing countries (Rand *et al*., 2000; UNEP, 2006).

Incineration, along with sanitary disposal of the residue, would therefore be useful alternative to traditional disposal methods, and have proven useful in Island nations such as Bermuda and the British Virgin Islands (Lettsome, 2008). Negative environmental consequences of incineration mostly revolve around airborne emissions. Certainly, incinerators should not be located where prevailing wind patterns would carry emissions over densely settled areas. Incineration volatilizes many compounds potentially harmful to human health: metals (especially lead and mercury), organics (dioxins), acid gases (sulfur dioxide and hydrogen chloride), nitrogen oxides, as well as carbon monoxide and dust (UNEP, 2006).

2.3 Ways that hinder effective solid waste management practices

Throughout history, human advancement has been intrinsically linked to the management of solid waste due to its effect on both people's general health and environmental health. Solid waste management (SWM) has a long and convoluted history (Nathanson, 2015). Systems of SWM can trace their roots all the way back to ancient times. One of the first instances of waste management occurred in the 4th century A.D. with the Ancient

Greeks. The Greeks had to deal with the multiple challenges of aligning waste removal systems with a growing population, lack of space, and sanitation problems. Waste management practices were very rudimentary with trash just being collected and transported to pits outside the city. It was not until urban populations boomed that garbage was viewed as a threat to human and environmental health. Cities began to grow rapidly to accommodate the growing population and conditions began to worsen for these cramped communities. The plagues that affected Europe between the 14th and 16th centuries were often perpetrated by vermin that thrived in the unsanitary urban conditions that were common during this time. Early waste-management techniques were developed during this period to combat the spread of disease but the political and social problems of the time did not see great strides in waste management (Nathanson, 2015).

Hindrances to effective Solid Waste Management (SWM) in developing countries can be identified. These are described as inadequate service coverage and operational inefficiencies of services; limited utilization of recycling activities; inadequate landfill disposal, and inadequate management of hazardous and health waste. The quantity of waste comprising solid, liquid and gaseous are generally considered to be growing across the globe as a result of increase in the world's population, increasing industrialization, increasing urbanization and rising standards of living (UNEP, 2004).

2.3.1 Inadequate Coverage

Solid waste collection schemes of cities in the developing countries generally serve only a limited part of the urban population. Majority of the people especially in slum areas lack waste collection services. These are usually the low-income earners living in poor conditions in peri-urban areas. One of the main causes of inadequate collection services is the lack of financial resources to cope with the increasing amount of generated waste produced (Zurbrugg, 2000).

2.3.2 Insufficient by-laws and regulation

There is no sufficient bylaws and regulation on solid waste management that can be used to govern solid waste management in a sustainable manner. Lack of SW sector analysis which could assist in identifying responsibility of individual organization for establishment of sustainable solid waste management resulting into haphazard solid waste

disposal. The existing bylaws governing SWM are not well understood by the stakeholders (Singh *et al*, 1998).

2.3.3 Ineffective Technologies and Equipment

Ineffective technologies and equipment has been another source that may contribute to the inadequate service coverage and operational inefficiencies. In a study looking at SWM in the developing world, many sources of waste might only be reached by roads or alleys, which may be inaccessible to certain methods of transport because of their width, congestion, and elevation. This is especially critical in unplanned settlements such as slums or low-income areas and thus largely affects the selection of equipment (Zhu *et al*., 2008). Another study done in India found that poor conditions of containers and inadequate maintenance and replacement of worn-out collection vehicles contributed to behaviors such as littering and illegal dumping by citizens who felt they could not properly dispose of trash because trash bins and waste services were not properly maintained (Hazra and Goel, 2009). Another major constraint is the misuse of technology, which has been documented in numerous cases where sophisticated and expensive technological recycling and composting plants as well as other waste management systems in developing countries have failed (as cited in Yousif and Scott, 2007). Reasons for a breakdown include a failure to adequately and extensively consult the public and relevant stakeholders, adoption of inappropriate technology characterized by imported mechanical and electrical parts which are too expensive to replace or too difficult to maintain, a failure to conduct economic and financial assessments, limited development of a market for recyclables, financial constraints, and absence of skilled technical personnel to manage these systems have been observed in many developing countries (as cited in Yousif and Scott, 2007). Techniques that have often proven effective in developed countries prove to be ineffective in many situations in developing countries that do not have the needed infrastructure, need, or know-how to properly implement these technologies. The lack of overall plans for SWM at the local and national levels results in solid waste technologies that are often selected without due consideration to their appropriateness in the overall SWM System.

2.3.4 Lack of Monitoring, assessment and evaluation

Most of the stakeholders, municipalities, the official waste collection companies, and households acknowledge the need for better monitoring and regulation of SWM but cite challenges at the institutional level as major barrier in overcoming these problems. One such major problem is the fact that in some locations during any change of government, all municipal office workers, even those not involved in elections, are replaced (Yousif and Scott, 2007). This presents a serious problem of continuity when trying to implement new projects that require time and planning which is often the case for projects concerning waste management.

2.3.5 Lack of Privatization/Decentralization of Services

Another potential way that hinders effective SWM practices is with identifying the role of institutions through the privatization or semi privatization of waste management with government transitioning into a more regulatory role. Decentralization of responsibility for SWMS requires a corresponding distribution of powers and capacities. It normally calls for revised organizational structure (Kruljac, 2012). In many developing countries there is currently great interest in involving private companies in SWM in order to cut down on costs, and this is slowly becoming the norm in SWM (Zhu *et al*., 2008). The involvement of the private sector to provide waste recovery services could help generate revenue to fund some aspects of solid waste management.

2.3.6 Operational inefficiencies

Operational inefficiencies are due to inefficient institutional structures, inefficient organizational procedures, or deficient management capacity of the institutions involved as well as the use of inappropriate technologies. With regard to the technical system, often the “conventional” collection approach, as developed and used in the industrialized countries, is applied in developing countries (UNEP, 2006).

The used vehicles are sophisticated, expensive and difficult to operate and maintain, thereby often inadequate for the conditions in developing countries. After a short time of operation only a small part of the vehicle fleet remains in operation transport also relies on operational vehicles, and frequent breakdowns coupled with parts shortages can immobilize collection vehicles for extended periods of time. For example, it was

estimated that in cities in West Africa, up to 70% of collection/transfer vehicles may be out of action at any one time, (UNEP, 2006).

2.3.7 Poor Policy Implementation

The purpose of the policy in solid waste management is to enhance the way of solid waste embraces the sustainable development concept. Sustainable development has emphasized the developments that meet the needs of the present without compromising the ability of the future generation to meet their own needs. Hence, the failure of policy implementation on the ground has brought massive impact on environment, economy and social development. Solid waste pollution is very harmful to human life, degrade the quality of environment and become a constraint towards stability of the economy development. Hence associated problems to solid waste management (UNEP, 2006).

2.3.8 Weather vagaries

This is a problem affecting solid waste management as per KCCA report 2011. Heavy rains, floods, strong winds, high temperatures and humidity which increase the bulky density hence a difficulty in their transportation to the disposal areas. When it rains heavily there is too much flow into the waste heaps ,which water continues and affects the surrounding community. Further still, after rain it shines so heavily in that the waste heaps produces strong ammonia gas which is stench thus polluting the general environment hence lowering environment quality.

2.3.9 Lack of Education and Awareness

Another major constraint seen throughout the developing world is the lack of education and awareness of effective waste-management practices (Singh *et al*, 1998).

One study in Gaborone, Botswana, found that even though citizens were aware of recycling and other sustainable waste-management techniques, this does not necessarily translate into participation in pro-environmental activities such as recycling initiatives. They appear to have not embraced waste management reforms amid their limited knowledge of such activities (Bolaane, 2006). The lack of interest in the environment creates a culture of non-participation of communities in decision-making processes. That stance enhances lack of responsibility for pollution and waste issues. Ultimately this produces communities that have little knowledge of, or concern for, their impact on the

environment (Poswa, 2001). What it may come down to is the difference between information and knowledge. Being presented with the information without prior knowledge may be ineffective in creating change. However, if prior knowledge of waste management was met with new information, these communities would be more willing to accept it and implement these changes. The need to improve public awareness of, and community participation in, waste management has been widely recognized by researchers as necessary to create sustainable waste systems and to promote environmental citizenship amongst community members (Lumbreras Martín and Fernández García, 2014). Typically, people are more likely to participate in waste management activities, for example recycling, when they observe others in their vicinity recycling.

2.3.10 Lack of Commitment among Stakeholders

The commitment among the stakeholders is crucial required to achieve effective policy implementation. In the context of Malaysia, the commitment among the stakeholders during solid waste management has been neglected. Significant interconnections exist between social competency and policy implementation. In fact, social response to a policy will significantly influence its effectiveness. The level of compliance and cooperation of citizen during policy implementation may depend on the social factors. For instance, social network is significance influence the civilian's compliance with the policy by diffusion of knowledge and information. Hence, the awareness of citizens with regard to the importance of the solid waste management can be raised definitely. Moreover, the Malaysian government is solely responsible for solid waste management policy formation and implementation (Hogland, 2013).

2.3.11 Lack of enough finance

Providing good solid waste management (SWM) services while also ensuring financial sustainability of the system continues to be a major challenge in cities of developing countries. Bahir Dar in northwestern Ethiopia outsourced municipal waste services to a private waste company in 2008. While this institutional change has led to substantial improvement in the cleanliness of the city, its financial sustainability remains unclear. So we need to know if the private company is able to generate sufficient revenues from their

activities to offset the costs and generate some profit (Cointreau, 2012). Budgetary constraints are often felt in developing countries where resources are limited and distributions of these limited funds are mismanaged. Many municipalities are struggling to achieve acceptable quality and coverage of service due to these financial constraints. A study conducted in Palestine stated that on average, up to 50 percent of residents lack collection services in urban areas of low and middle-income countries. There are limited opportunities for the development of sustainable SWMS, as government budgets are limited and proper waste collection is overlooked (Al-Khatib *et al*., 2010). Another study conducted in Kenya found that much of the municipal budget for waste management is directed to pay for an over-staffed and under-qualified workforce (Henry et al., 2006), and not allocated to make improvements within their own infrastructure. The data from another study suggests that the inadequacies of vehicles, supervisors, and solid waste collection crews were the major obstacles to the management of solid waste in the country (Mwanthi and Nyabola, 1997). These problems were attributable to financial constraints and possibly to misappropriation of finances within the offices that manage waste.

2.3.12 Urbanization

Urbanization has resulted in a substantial increase in solid waste generation in urban centres. Urban areas in India for example alone generate more than 100,000 metric tonnes of solid waste per day, which is higher than many countries' total daily waste generation. Large metropoles such as Mumbai and Delhi generate around 9000 metric tonnes and 8300 metric tonnes per day respectively. Due to sustained rapid economic growth, Indian cities are expected to only intensify their consumption patterns (UNEP, 2006).

2.4 Effects related to different waste management practices

Waste is a growing challenge due to increasing production and consumption, especially in urban areas where the waste problem is magnified by overpopulation (Guerrero, Maas, &Hogland, 2013).

According to the World Bank, poorly managed waste has an enormous impact on health, local and global environment, and economy; improperly managed waste usually results in

down-stream costs higher than the cost of managing the waste properly in the first place (Hoornweg and Bhada-Tata, 2012).

The environmental problems caused by inadequate waste management lead to negative repercussions for economic and human development through decline in health, loss of workdays and unnecessary municipal costs, to name a but few.

2.4.1 Effects on environment

The decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations. Very few existing landfills in the world's poorest countries would meet environmental standards accepted in industrialized nations, and with limited budgets there are likely to be few sites rigorously evaluated prior to use in the future. The problem is again compounded by the issues associated with rapid urbanization. A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture (Cointreau-Levine, 1997). A second problem with these gasses is their contribution to the enhanced greenhouse gas effect and climate change. Liquid leachate management varies throughout the landfills of the developing world. Leachate poses a threat to local surface and ground water systems (poswa, 2001).

2.4.2 Effects on health

Progress of modernization and industrialization has had its share of disadvantages and one of the main aspects of concern is the pollution it is causing to the earth be it land, air, and water. With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. This waste is ultimately thrown into municipal waste collection centers from where it is collected by the area municipalities to be further thrown into the landfills and dumps. However, either due to resource crunch or inefficient infrastructure, not all of this waste gets collected and transported to the final dumpsites. If at this stage the management and disposal is improperly done, it can cause serious impacts on health and environment (Levine, 1997).

Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. There are also specific risks in handling wastes from hospitals and clinics. For the general public, the main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats (krulja, 2012).

Chemical poisoning through chemical Inhalation, Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rats, and other creatures that in turn spread disease. Normally it is the wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby to a rise in the health problems. The plague outbreak in Surat is a good example of a city suffering due to the callous attitude of the local body in maintaining cleanliness in the city. Plastic waste is another cause for ill health. Thus excessive solid waste that is generated should be controlled by taking certain preventive measures (Speise, 2010).

Certain chemicals if released untreated, e.g. cyanides, mercury, and polychlorinated biphenyls are highly toxic and exposure can lead to disease like cancer or to death. Cancer was reported among residents who were exposed. This study will be used to find out connection between health and hazardous waste in the world (krulja, 2012).

Neurological disease is also one of the effects related to different waste management practices where the brain, spinal cord, and nerves can be impaired. Together they control all the workings of the body. When something goes wrong with a part of one's nervous system, there can be trouble moving, speaking, swallowing, breathing, or learning. There can also be problems with one's memory, senses, or mood (UNEP, 1996).

Chronic respiratory diseases, incineration operators are at risk of chronic respiratory diseases. Organic waste poses a serious threat, since they ferment creating conditions favorable to the survival and growth of microbial pathogens. Direct handling of solid waste can result in various types of infectious and chronic diseases including cancers and respiratory infections resulting from exposure to dust and hazardous compounds (Muggaga, 2006). Cancer, several geographical comparison studies have investigated cancer mortality and incidence around waste sites. Increased frequency of cancers in

divisions containing hazardous waste sites was found in most studies, particularly for gastrointestinal, oesophageal, stomach, colon and rectal cancer. (UNEP, 2000). So it must be noted that Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition (UNEP, 2006). Although less well established, results from large US cohort studies suggest that long-term exposure to low concentrations is associated with chronic health effects such as increased rates of bronchitis and reduced lung function, shortened life span, elevated rates of respiratory symptoms and lung cancer.

Congenital malformations, poor waste management malformations have been reportedly led to infant mortality (death) in the US and many other developed nations. Examples include heart defects, cleft lip and palate, spina bifida, limb defects and down syndrome. With the poor waste disposal management practices it is evident that solid waste ends up in this system which will act as a reservoir /breeding space for various diseases causing vectors like flies and mosquitoes hence effecting people's general health(UNEP, 1996).

Birth defects and reproductive disorders. Reproductive effects associated with landfill sites have been extensively observed and include low birth weight, fetal and infant mortality, spontaneous abortion, and the occurrence of birth defects (Goldman *et al*, 1996). Trends in low birth weight and neonatal deaths were found to correspond closely with time and quantities of dumping at a large hazardous waste disposal site in California, with significantly lower birth weights in exposed areas than controlled areas during the periods of heaviest dumping (Goldman *et al*, 1996). However, a study of residence near MSW incinerators found statistically increasing risk with increasing proximity for all cancers and for colorectal, lung, liver and stomach cancers, although there was evidence of residual confounding for all cancers of stomach and lung. Because of the substantial level of misdiagnosis which can occur among registrations and death certificates for liver cancer (Pheby *et al*, 1998).

2.5 Conclusion

The involvement of people and private sector through NGOs could improve the efficiency of MSWM. Public awareness should be created among masses to inculcate the health hazards of the wastes. Littering of MSW should be prohibited in cities, towns and urban areas notified by the state government through a policy formulation. House-to-house collection of MSW should be organized through methods like collection on regular pre-informed timing and scheduling (Speise, 2010). The collection bins must be appropriately designed with features like metallic containers with lids, and to have a large enough capacity to accommodate more than the expected waste generation in the area, with a design for mechanical loading and un-loading, placement at appropriate locations, etc. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. Proper maintenance of the MSW transportation vehicles must be conducted. Currently, at the level of waste generation and collection, there is no source segregation of compostable waste from the other non-biodegradable and recyclable waste. Proper segregation would lead to better options and opportunities for scientific disposal of waste. Recyclables could be straightway transported to recycling units. This would help in formalizing the existing informal set up of recycling units. It could lead to several advantages such as enabling technology up gradation, better quality products, saving of valuable raw material resources of country, reducing the need for landfill space, a less energy-intensive way to produce some products and employing labor in recycling industries. Organizing the informal sector and promoting micro-enterprises are an effective way of extending affordable services. Promotion and development of recycling is a means of upgrading living and working conditions of rag pickers and other marginalized groups. Most of the MSW in India is dumped on land in an uncontrolled manner. Such inadequate disposal practices lead to problems that will affect people's general health and animal health and result in economic and environmental losses. The current regulations (MSWM rules, 2000) are very stringent. Norms have been developed to ensure a proper MSWM system. Unfortunately, clearly there is a large gap between policy and implementation. The producer responsibility is to avoid having products on the market that cannot be handled effectively and environmentally correctly when they become waste products. A new

survey should be carried out on the generation and characterization of MSW. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results. Finally, the study concluded that the lack of resources such as financing, infrastructure, planning and poor policy implementation, weather vagaries and leadership, are the main barriers in MSWM. The increase of service demands combined with the lack of resources for municipalities are putting a huge strain on the existing MSWM systems (Chakrabarti .N, 1995).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1Introduction

The main focus of this study was to explore the effects of solid waste disposal on people's general health in Makindye division. This chapter covered a detailed description of selected methodology used which therefore involved research design, study population, target population, sample size determination, sampling technique, data collection methods and ethical considerations.

3.2Research Design

The design was an exploratory and descriptive survey research that adapted both quantitative and qualitative methods. This design was used because descriptive studies could yield rich data that lead to detailed analysis such that important recommendations could be developed. It was also relatively cheap and it exposed the subject to be observed in a completely natural and unchanged environment. The benefit of the qualitative approach is that the information is richer and has a deeper insight into the phenomenon under study.

Quantitative research is the systematic empirical investigation of observable phenomena via statistical, mathematical or computational techniques. Qualitative research data collection methods on the other hand are time consuming; therefore data is usually collected from a smaller sample. The objective of quantitative research is to develop and employ mathematical models, theories and/or hypotheses pertaining to phenomena. There are a variety of techniques that can be used to collect data in a quantitative research study. However, all of them are geared towards numerical collection.

3.3Study Area

Figure 2: Map showing parishes in Makindye division KCCA, 2017

The study was conducted in the Central Region of Uganda, Makindye division in particular. Makindye Division is in the southeastern corner of the city, bordering Wakiso District to the South and West. The eastern boundary of the division is Murchison Bay, a part of Lake Victoria. Nakawa Division lies to the northeast of Makindye Division. Kampala Central Division lies to the north and Lubaga Division lies to the northwest. The coordinates of Makindye Division are: 0°17'00.0"N, 32°35'00.0"E (Latitude: 0.283334; Longitude: 32.583334). Makindye, where the divisional headquarters are located, sits approximately 6 kilometers (3.7 mi), by road, southeast of Kampala's central business district.

The area was chosen because of its population. The concentration of people around this

area had therefore provided a good niche for such research to be establish in here since most of their objectives target such communities hence their SWM practices affecting their general health. Parishes in the division include Bukasa, Buziga, Ggaba, Nsambya, Kabalagala, Muyenga, Katwe, Kibuli , Kibuye, Kisugu, Lukuli, Luwafu, Munyonyo, Salaama and Wabigalo.

The study focused much on Ggaba parish, Kabalagala, Katwe, salaama, Kibuye and Munyonyo.

Ggaba is located on the Northern shores of Lake Victoria, at the Southern tip of the city of Kampala. It is bordered by Murchison Bay on Lake Victoria to the South and East, the village of Kawuku to the Northeast, Bbunga to the North, Buziga to the Northwest and Munyonyo to the southwest. It lies in Makindye Division, one of the five administrative boundaries of the city.

3.3 Study Population

3.3.1 Target population

The study was performed in Makindye division which has a population of approximately 409,500 People in the informal settlements of Makindye division (KCCA, 2011).

The target population for this exploratory study involves the parishes with their population size and number of household.

Table 1: Showing summation of population size and number of households

	Ggaba	Kabalagala	Munyonyo	Kibuye	Salaama	Katwe	Total
Population size	17000	30000	23000	25000	22000	25000	142000
Households	3400	5000	4700	3000	6000	5000	27100
Total	20400	35000	27700	28000	28000	30000	169100

Source: **KCCA, 2011**

3.4 Sampling Procedures

Simple random sampling was used to select the sample of households involved in the study and purposive sampling was used for the selected key informants who comprised of

the KCCA agents, health officials, environment officials and local leaders. Interviews were administered to leaders who occupy senior positions because they were believed to have enough essential information for this research (Busha& Harter, 1980) and to obtain detailed information about their views. The interviews are also used not only to answer the research questions under the study, but also to obtain ideas of the persons being interviewed regarding their feel and understanding on the current solid waste effects updates in their area of operation. A detailed interview is conducted with key an informant who is expected to be very informative swith solid waste details in the area of the research.

3.4.1 Sample Size

The study samples were determined by Slovene's Formula for sample size determination. Slovene's formula is used to calculate the sample size (n) given the population size (N) and a margin of error (e). It is computed as n = N / 1+N (e) 2. Slovene's formula is used when nothing about the behavior of a population is known at all.

The researcher used the Slovene's formula.

The population distribution of the respondents in the various categories is shown below:

Table 2: Sample Size

NO	PARISHES	NUMBER OF PEOPLE	NUMBER OF HOUSEHOLDS	SAMPLE SIZE
1	Ggaba	17000	3400	65
2	kabalagala	30000	5000	72
3	Kibuye	25000	4000	55
4	Salaama	22000	6000	75
5	Muyonyo	23000	4700	45
6	katwe	25000	5000	85
TOTAL		142000	27100	393

Source: Generated by the researcher basing on random sampling

Sample size = n = $\frac{N}{1+N(e)}2$

N = population size

n = sample size

e = Level of significance of error assumed to be 0.05.

Therefore

$$n = \frac{27100}{1+27100(0.05)^2}$$

$$n = \frac{27100}{67.8}$$

n= 393

3.5 Data Collection technique

Both primary and secondary data were used in the course of conducting this study. The research used the following research instruments: Questionnaires; Key Informant; Interview guides; observation check lists and documentary reviews.

3.5.1 Questionnaire

For qualitative data, questionnaires were administered to a total of three hundred ninety three respondents who were randomly selected. Questionnaires (Appendix, 1) entailed open and close ended structured questions that examined sequence, clarity and face – validity from respondents (Webb *et al*, 2007).

The questions focused on the perceptions of the respondent groups regarding the effects of solid waste management practices on the local people's general health**.** The open-ended questions aimed at opening up more discussions while closed questions aimed at collecting particular responses.

3.5.2 Key Informant Interviews

Ten key informants were interviewed, these included KCCA agents, health officials and local leaders. A key informative schedule (Appendix, 2) was designed to obtain information relate to associated diseases and effects on people's general health as a result

of different solid waste management practices in Makindye division. Qualitative researchers relied quite extensively on in-depth interviewing. Aberbach and Rockman, (2002) described interviewing as “a conversation with a purpose”. It may be the overall strategy or only one of several methods employed. The interviews helped the researcher to fully understand most senior official’s experience KCCA agents, Health officials, Environment officials and local leaders} in relationship to promoting good solid waste management and the strategies implemented or ought to be implemented to help improve health and people’s general health.

3.5.3 Observation

This was done to gather information about how the program was actually conducted. The researcher understood the processes, knowledge and views of community and their perceptions on the effects of solid waste management practices on the local people’s general health**.** Observation visits were carried out at disposal areas to identify and assess the associated diseases and effects on people’s general health as a result of different solid waste management practices in Makindye division available strategies and tools used, also a checklist was used.

3.5.4 Documentation reviews

Relevant records, such as solid waste books and records from authorities and all other respondents’ offices that were easily accessible were reviewed. This was done to ascertain the dynamics in sustaining production using the existing marketing models for communities such included memos, marketing brochures, farmer’s production records and minutes of the previous years. These gave comprehensive and detailed information on the status of organic produce markets on domestic levels.

The reviews of documents were rich in portraying the values and beliefs of participants in the study. Minutes of meetings, logs, announcements. Formal policy statements and letters were also useful in developing an understanding of the setting or group studied (Berelson, 2007). Important journals, statutes, Acts, Manuals, Guidelines, as well as minutes.

The purpose of conducting documentary reviews was to justify information that could be obtained from interviews and questionnaires.

3.6 Data analysis and presentation

In an effort to come up with an inferring meaningful analysis, interpretation, conclusion and recommendations, data was analyzed and presented. In line with this, cross data validation were done to establish the relationship between the independent variable solid waste disposal dependent variable effects on people's general health in Makindye.

3.6.1 Quantitative data analysis

Data was edited, coded and cleaned before analysis was done. A statistical package like SPSS was used for data entry and analysis. Data was also condensed into frequency counts and tables and graphs as found appropriate.

3.6.2 Qualitative data analysis

Qualitative researchers rely quite extensively on in-depth interviewing. Aberbach and Rockman, (2002) described interviewing as "a conversation with a purpose". It may be the overall strategy or only one of several methods employed. The interviews helped the researcher to fully understand most support organization official's experience in relationship to promoting good solid waste management and the strategies implemented or ought to be implemented to help improve people's general health.

3.8 Ethical Consideration

For the success of this study the researcher adhered to the following logistical and ethical consideration. Sought permission from the university through and from his place of work and the consent of the respondents were sought. All information that was collected from the respondents was treated with utmost confidentiality, since the identity of the respondents and their positions where concealed. The information was collected basing on voluntarily basis and no one was forced to divulge any information at any given time.

3.9 Limitation to the study

Language barrier among some respondents, this made communication rather difficult calling for a translator in order to carry on with the research.

Some of the respondents also thought that the researcher was carrying out the study to be paid by some organizations so they asked for some financial facilitation but I overcame it by telling the respondents that information was for academic purpose only.

The scarcity of finances was a great challenge to the researcher but the researcher solved the issue by using his savings and borrowing from friends.

Limited time being one of the factors which was not on the researcher's side and it inconvenienced his work, honestly, he then changed to be a good time manager performing everything at the fixed time thus overcoming the limitation of time

The study encountered some factors which tried to interfere with the validity of the study such as respondents' act of copying from each other in the exercise of questionnaire form of answering and consultative tendencies from one another or the similar cause. However the researcher identified it out and it was rectified amicably with respondents without delay.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.0 Introduction

This chapter deals with the results and findings obtained from the survey carried on the effects of solid waste management practices on People's general health carried out in Makindye division, Kampala District, Uganda. The results of the survey cover responses from individuals from different households and key informants on solid waste practices in the district.

4.1 Demographic characteristics of survey sample

The participants were respondents from Makindye division. Selection of participants in those categories were based on simple random sampling which gave every member in the division an equal chance of being selected for the sample.

In this study, there were slightly more female participants (53.5%) than male participants (46.5%). Majority of participants were single with no partner or with a regular partner (54.5%), the married were 43.4% and a smaller proportion were separated (1%) and widowed (1%). The largest group (54.5%) of the participants had spent more than two and a half years in Makindye Division.

Similarly, most of the respondents (38.4%) were of the age group 20-24 years. Nearly all the survey participants have attained some form of formal education although majority completed Tertiary (44.44%) and Secondary (25.3%) education (See Table 4.1).

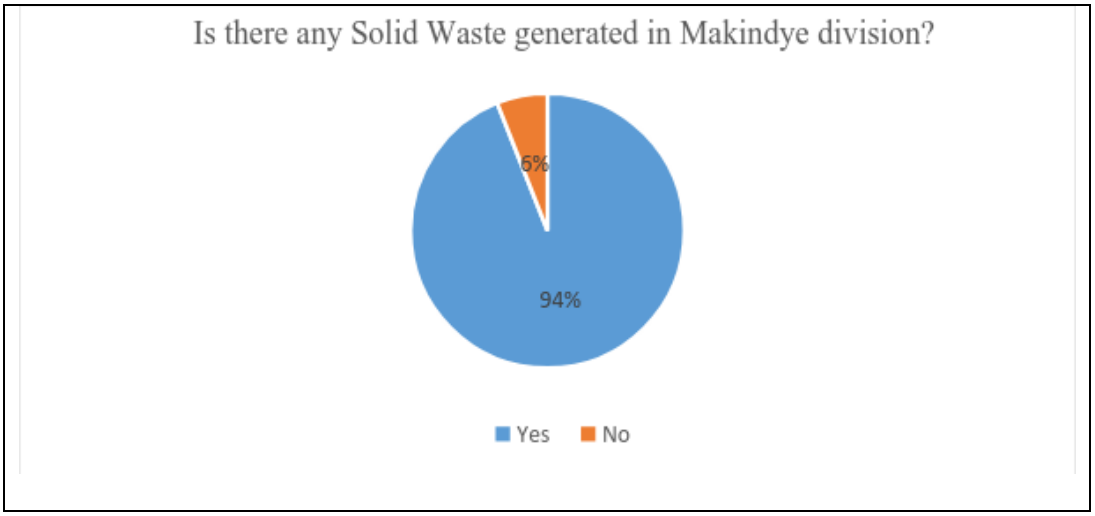
Table 4.1: Basic characteristics of respondents

Indicator	Freq (Total= 393)	Percent (%)
Gender		
Male	163	46.5
Female	230	53.5
Age Of respondent		
15-19	50	9.1
20-24	82	38.4
25-29	65	27.3
30-34	55	13.1
35-39	27	1.0
40-44	48	8.1
45-49	27	1.0
Above 50	39	2.0
Level of Education		
No education	05	5.1
Primary	04	4.0
Secondary	25	25.3
Tertiary	44	44.44
Others	18	18.2
Marital Status		
Single	182	54.5
Married	109	43.4
Widowed	51	1.0
Separated	51	1.0
Length of time spent in Makindye		
Between 6months and12 months	65	8.1
Between 1year and 1½years	80	25.3
Between 1½years and 2years	30	4.0
Between 2years and 2½years	65	8.1
Above 2½years	153	54.5

Source: Field data, 2017

4.2 Nature of solid waste disposed in Makindye division

Majority (94%) of the respondents agreed that there was solid waste generated in Makindye Division, (See Figure 4.1).



Source: Primary Data 2017

Figure 4.1: Is there any solid waste generated in Makindye Division?

The solid waste generated from the division was mainly from paper (40.4%), plastics (30.3%), and lower proportion from Yard trimmings (10.1%), food scrap (7.1%), glass (6.1%), metals (4.0%) and textile/clothing (2.0%).

(See Figure 4.2).

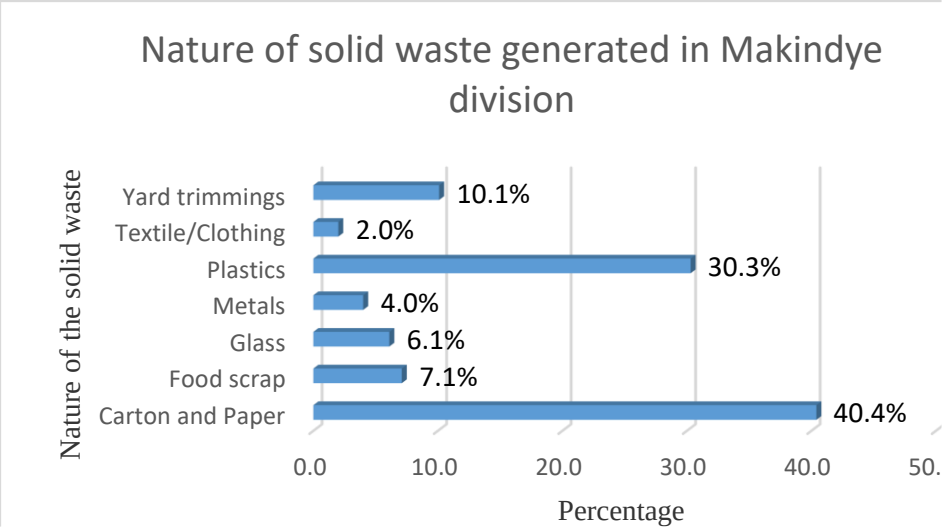


Figure 4.2: Nature of solid waste generated in Makindye Division.

From figure 4.2 nature of solid wastes generated, common examples of each nature were observed.

Solid waste generated from glass: From the solid waste generated from glass, 85.86% was from bottles, 6.06% from window glass, 5.05% from ceramics and 2.02% from plates. This is in agreement with Namuwongo Industrial area local council two chair person who stated that from a report presented to the council, glasses were generated mostly from happening areas and even poorly deposited. The area is surrounded by many bars and drink up places, as well as small restaurants. Bottles that contained chemicals were not offered for recycling; those without chemicals were offered for recycling.

Solid waste generated from Carton and paper: Most of the carton and paper solid waste was generated from paper bags (82.83%) and the least of it was generated from newspapers and serviettes. Other forms of the waste were old books, package boxes and used magazines. Following the government's attempt to ban the use of polythene bags, there was increased use of the paper bags especially with the low income businesses like the chapatti makers, pancake makers and many alike.

According to a local resident and also a snack vendor in Makindye East Constituency, on average he buys about 20 cartons of Azam flour a day, but he sells 80% of them. Most of the package materials are left with him which he later dumps at a nearby garbage collection point.

Solid waste generated from yard trimmings: Most of the yard trimmings were from grass (85.86%), 5% from ornamental, 4% from tree branches and 4% from flowers. Other yard trimmings observed were also from leaves. This is in agreement with one of a Floriculturist in Nsambya/Kirombe area of Makindye West Constituency who said that grass is the biggest component of solid waste from yard trimmings.

Solid waste generated from metallic substances: According to the results from the field most of the solid waste from metals was mainly from folks (54.55%), from tins/cans (16.16%) and from spoons (12.12%). This is in agreement with one of the key informants and a local metal Smelter and Weldor at Katwe 1 Parish, Makindye West Constituency who stated that in addition other metals like old iron sheets, garage pipe and off cuts from welding were also generated.

Solid waste generated from plastics: Polythene bags constituted the highest percentage (79.8%) of the solid waste from plastics, 14.14% from mineral water bottles, and 4.04% from cups. It was also observed that there was also waste from wires. "Polythene bags are very prominent in the medium to high income areas of Makindye Division because, these people purchase a lot of packed materials and continuously discard plastic packs as waste after use." Explanation by Miss Florence Kiwanuka, an Environment Office in Makindye Divison.

It was observed that residential areas that are of high density are not provided with garbage collection services. In such environments, disposal of household refuse by the different individuals is done in an environmentally unfriendly manner. These plastics and polyethylene papers are used and yet they do not decompose, and also inhibit water penetration into the soil. (Wilson *et al*., 2006)

4.3 Solid Waste Management Practices In Makindye Division

Different solid waste management practices were dependent on the nature of solid waste. Most of the solid waste in the division was burnt. 40.4% of the food waste is burnt, 52.3% of the yard trimmings were burnt, 75.76% of the paper/card board was burnt, and 56.57% of the plastics were burnt. Most of the metal solid waste was recycled (36.36%) whereas most of the glass solid waste was put on the garbage truck-in yard (43.43%). The management practices employed was in agreement with the recommendations made in

the Kampala City Council, 2006 Solid Waste Management Strategy Report.

The table below shows how residents in Makindye division get rid of different types of garbage, (See table 4.3)

Table 4.2: How residents get rid of different types of garbage

Types of garbage	Solid waste management practices							
	Burn (%)	Burry (%)	River/Gully (%)	In yard (%)	Recycle (%)	Reuse (%)	Compost (%)	Total (%)
Food waste	40.40	0.00	20.20	12.12	16.16	3.04	8.08	100
Yard trimmings	52.53	2.02	14.14	18.18	3.03	0.00	10.10	100
Paper/card board	75.76	5.05	3.03	3.03	2.02	8.08	3.03	100
Plastic	56.57	8.08	5.05	1.01	12.12	17.17	0.00	100
Metals	15.15	9.09	13.13	10.11	36.36	16.16	0.00	100
Glass	0.00	16.16	22.22	43.43	16.16	2.03	0.00	100

Source: primary date, 2017

The most common solid waste management practices employed in Makindye Division included reuse, recycle, waste reduction, energy recovery and dumping. Most of the residents used the dumping method (57.58%), and the recycle method (24.24%), however, other practices like reuse, waste reduction, energy recovery were not commonly used. This is in agreement with the former Mayor Makindye Division; 2012 upto2016. The other observed methods used by the residents were burning, burying, and collection in one place to be taken by the city council trucks. The researcher observed that various alternatives of storage items are available to the people including plastic bags, Low Density Polyethylene (LDP) bags, old metallic tins, specialized waste containers, paper boxes, just to mention a few. From the interviews that held with the respondents from the two research areas, it was found out that the majority of the households, 66 especially in

Luwafu parish use gunny bags as their main primary storage facility. The reason is that under the contract between Nabugabo Updeal Limited and the Makindye Division Authorities, the private service provider is supposed to supply storage facilities to its clients. The costs of supplying these facilities are covered up within the fees that the clients have to pay for the waste removal services. 'Using plastic bags does not only keep the waste protected from scavenging dogs, but also saves us a lot of time because the bags are easy to handle.' Excerpt from one of the field employees of Nabugabo Updeal Limited However, through observation, I found out that most of the households within Katwe I parish (a low income area), were using things such as, broken plastic basins, tins and LDP bags. When the chairman of this parish was asked as to why this was so, his response was that, his residents were poor people who could not afford to pay for the facilities provided by the private company. In his own words, 'you cannot tell people to pay for waste storage containers when they do not have money for food.' This statement was shared by the Director of Nabugabo Updeal Limited who said that they find it too hard to make people from low income areas to pay for the waste containers.

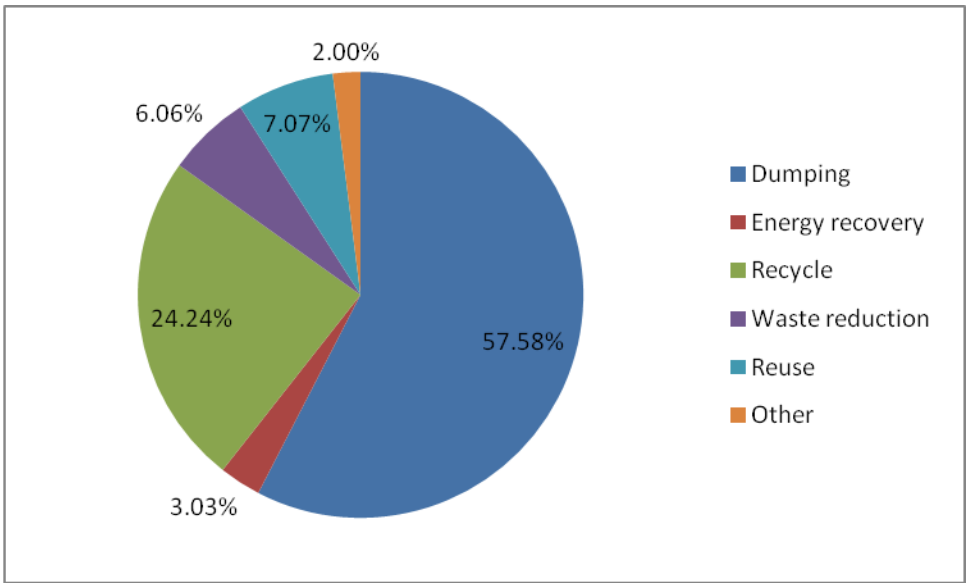


Figure 4.3 Solid waste practices employed in Makindye Division

Community members sorting recyclable solid waste to be transported to recycling plants as it can be observed in figure 4.3.

Figure 4.3: Sorting recyclable solid waste Author, 2017.

4.4 Factors hindering effective management of solid waste in Makindye division

Table 4.4 shows the factors hindering effective solid waste management. Inadequate coverage was highly rated (48.86%). Inadequate coverage results into heavy accumulation of waste hence unsanitary conditions especially during the rainy season.

Lack of enough finance (22.73%) was rated second, providing good solid waste management (SWM) services while also ensuring financial sustainability of the system continues to be a major challenge in Makindye. KCCA left municipal waste services to a division level. While this institutional change has led to substantial detoriation in the cleanliness of the city, its financial sustainability remains unclear. So we need to know if the division is able to generate sufficient revenues from their activities to offset the costs and generate some profit.

Insufficient by-laws and regulation (11.36%) was rated third, It was reported that there is no sufficient bylaws and regulation on solid waste management that can be used to govern solid waste management in sustainable manner. Lack of SW sector analysis which could assist in identifying responsibility of individual organization for establishment of sustainable solid waste management resulting into haphazardly of solid waste disposal. It was observed that existing bylaws governing SWM are not well understood by the stakeholders.

High illiteracy levels(4.55%), among households in Makindye brings about ignorance about waste separation , collection and storage thus discarding the waste anywhere one of the local resident said that that storage containers are labeled in English and I cannot read them therefore it becomes hard for me to place the waste correctly in their respective containers. So provision of training for all stakeholders so as to understand the best way of handling solid waste including sorting practices is necessary. Education and awareness regarding proper handling of solid waste for Makindye traders and leaders is minimal. (See table 4.4)

Weather vagaries (7.95%) This is a problem affecting solid waste management as per KCCA report 2011.heavy rains, floods, strong winds, high temperatures and humidity which increase the bulky density hence a difficulty in their transportation to the disposal areas. When it rains heavily there is too much flow into the waste heaps which water continues and affects the surrounding community further still ,after rain it shines so

heavily in that the waste heaps produces strong ammonia gas which is stench thus polluting the general environment hence lowering environment quality.

Urbanization (4.55%) It has been reported that urbanization has resulted in a substantial increase in solid waste generation in urban centres. Urban areas in Makindye for example alone generate more than 10,000 metric tonnes of solid waste per day, which is higher than expected as per KCCA report 2011.

Table 4.3: Factors hindering effective solid waste management in Makindye Division

Factors hindering effective waste management	No. of respondents	Percentage
Inadequate coverage	86	48.86
Weather vagaries	14	7.95
Awareness	8	4.55
Lack of enough finance	40	22.73
Urbanization	8	4.55
No sufficient by-laws and regulation	20	11.36

Source: Primary date 2017

As per the field findings there are potential risks to environment and health from improper handling of solid wastes. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. There are also specific risks in handling wastes from hospitals and clinics. For the general public, the main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats, respiratory diseases, floods and greenhouse gasses among others. Uncontrolled hazardous wastes from industries mixing up with municipal wastes create potential risks to human health. Traffic accidents can result from toxic spilled wastes. There is specific danger of concentration of heavy metals in the food chain, a problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/sewerage system and /or open

dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle this was in agreement with the division environmental officer.

Diseases Related to poor solid waste management and their effects on people's livelihoods in Makindye Division

Uncollected waste was illegally and indiscriminately dumped in open spaces along roadsides and streets, water bodies, and drainage channels that are eventually blocked, leading to a filthy environment. The filthy environment is prone to flooding, and diseases like cholera and diarrhea, as well as to mosquito breeding, which exacerbates the malaria situation (Mugagga, 2006).

Cholera, dysentery, diarrhea, tetanus, malaria and typhoid were identified as the major diseases associated with poor solid waste disposal. Diarrhoea was highly rated (33.45%) whereas cholera (27.03%) and malaria (18.24%) where rated in the second and third positions. Tetanus was the least rated among them all (3.8%), (See figure 4.3).

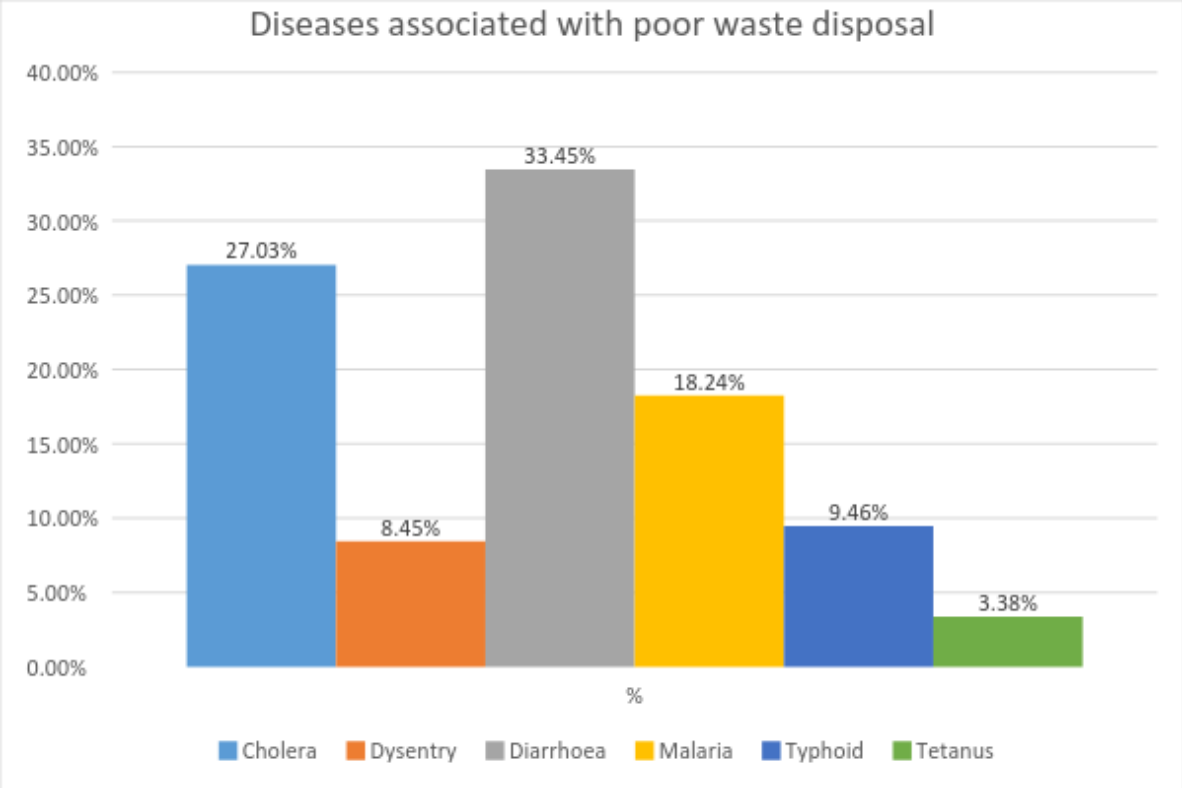


Figure 4.4 Associated diseases due to poor solid waste management

This is in agreement with a study by Kanat (2010), on waste management where he found out that these unpleasant sanitary conditions lead to an increase in the outbreak of diseases.

The mismanagement of solid waste was said to affect the productivity and other infrastructure an example is when waste is dumped on the road side which end up blocking the rain run off hence flood resulting to damage road. The major risks associated with poor management of solid waste included the spread of diseases, overall environment pollution (air, water, soil) including emission of greenhouse gases. The physical and chemical hazards generally included dangers associated with direct contact with sharps and/or infected sharps use of certain toxic chemical/solution, risks of explosion and fire hazards of certain solvents. (Mugagga, 2006)

"Poor solid waste management was said to give budgetary problems to the government as it leads to absorption of a large amount attributed to public cleaning by the KCCA and the cost of doing the actual work. Additionally, the scattered waste takes more time to load into the collection vehicle, resulting in lower vehicle productivity." Explanation by Ms. Kiwanuka Florence, Environment officer, Makindye Division.

According to John Tugaineyo, Kibuli Area Councillor, achieving good sanitation especially in the slum areas of Kampala is still a challenge. Like in other Kampala slums, Kibuli-Lubowa zone has a high prevalence rate of waterborne diseases like Cholera, dysentery, diarrhea, malaria and Typhoid. This is mainly due to poor disposal of garbage and faces which later end up in the drainage system. The community lacks common dumping sties and this fuels uncontrolled disposal of waste. The zone has a high and ever growing population associated with increasing tenements which later turn the place into a slum with different characters of people. The people in these areas come from diverse backgrounds and have different cultural practices of which some promote poor sanitation. Some people do not use the pit latrines and some pregnant women fears to drop their babies in the latrine hence prefer using bushes. There are even some landlords that do not construct latrines and their tenants find it embarrassing to use nearby latrines.

From figure 4.4 it is observed that the child is at risk of ingesting waste that may cause health risk.

Figure 4.4 Child crawling across an open sewer where traces of garbage can be seen openly scattered Author 2017.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This research study was aimed at establishing the effects of solid waste management

practices on the local people's general health in Kampala, Makindye Division. This chapter is divided into three sections. The commencing section covers the conclusion against the objectives, the second covers the recommendations while the last section suggests areas for further research.

5.1 Conclusion

The following are the summary and conclusions of the findings which were identified during site visits:

The research found out that most of the solid waste was generated from bottles mainly because of bars and drinking places in the division, paper especially the paper bags used for packaging. The polythene bags which are used mostly for also packaging together with the forks in the takeway foods and grass from the trimmings. However from the findings collection of the waste is not adequate. This is dangerous to public health and environment; the study showed that Makindye division produced more of organic waste; therefore, it is suitable for composting but worse enough all wastes are mixed and there is no sorting of biodegradable and non-biodegradable of the solid waste produced.

It was found that from the different types of solid waste management practices employed in Makindye Division, majority of the residents used the dumping method mostly, and the recycle method. However, other practices like reuse, waste reduction and energy recovery were not commonly used. Findings also showed that inadequate and low standard of storage facilities combined with low frequency of solid waste collection led to scattering of solid waste around the division. This study revealed that only 44% of households used dustbins for waste collection. Some solid waste is placed in plastic bags and bamboo baskets while some is randomly disposed off and leaks into the sewerage system. Likewise, there was a scarcity of skips at market collection points. There are few collections, resulting in skips overflowing due to the excessive accumulation of waste at the collection points, which have made the area a potential danger to human health and the environment.

According to the findings inadequate coverage was highly rated. Inadequate coverage results into unsanitary conditions especially during the rainy season. Illiteracy levels was rated second, burning waste on the disposal sites can cause major air pollution, it affects

the climate by increasing the GHG emissions, beside the effect on human health by causing illness (respiratory diseases) and the risk of fire can spread to the adjacent properties, and make disposal sites dangerous.

Associated diseases that the locals suffer as a result of different poor solid waste management practices in Makindye division.

As per results cholera, dysentery, diarrhea, tetanus, malaria and typhoid were identified as the major diseases associated with poor solid waste disposal. Diarrhea was highly rated whereas cholera and malaria where rated in the second and third positions. Tetanus was the least rated among them all.

5.2 Recommendations

- The study observed that there was no sorting of solid waste in Makindye Division, and so the separation of solid waste should be considered from the point source, Apparently, there is an urgent need to increase the number of facilities to collect waste around the division as well as the number of the collections. In order to overcome the problem, movable plastic/metallic bins with a bigger volume are

enough to separate biodegradable and nonbiodegradable solid waste.

- An adequate number of skip containers must be provided at the collection Centre, along with frequent collections. Alternatively trolleys of a bigger size could be placed to collect the solid waste, since they could also be easily transported to the dumping site. The study recommended that disposal site should be equipped with proper solid waste disposal facilities include sanitary land fill. Composting is a preferable recommendation for the high amount of biodegradable waste generated by the division. The compost could be very useful for making agriculture and urban gardening productive and non-biodegradable solid waste should be collected, segregated and transported to recycling centers.

- As a practical example of waste avoidance to reduce the number of plastic bottles and Polythene bags (Kavera) dumped indiscriminately is to introduce a deposit service fee in order to reduce the amount of plastics dumped. Practically the business owners/producers would be encouraged to integrate a deposit fee on the container i.e. sale of juice, water and other merchandise is done and packed in returnable cups/bags where a fee as an incentive is placed on returning the cup/bag to the seller. This can be done in such a way that these cups/bags can be returned anytime and anywhere for a full refund, ensuring a service of maximum convenience to users. This can greatly reduce the amount of solid waste generated most especially from business enterprises.

- A link should be established between recycling companies and communities' groups. This will serve two purposes, one it will reduce the amount of garbage entering the waste stream and as such costs of having to transport it to the landfill where companies currently collect it. And two, it will create employment and income for the communities while at the same time reduce on the garbage problem and saving landfill space.

- The study recommends that from the findings, KCCA needs to have a deliberate policy that encourages the community to play a role in addressing the solid waste problem. There is need to encourage local communities to organize to address the

solid waste problem.

- From the findings it is observed that involvement of the private sector in SWM is of paramount importance. It is therefore highly recommended that they should be involved in collection, transportation and treatment processes such as composting and recycling.
- There is need to involve the various stakeholders in developing garbage-related policies. The various stakeholders represented should constitute the implementation committees. In addition, regular reviews should be done during the implementation process so that the realities on the ground are incorporated.
- Makindye Division should attempt to build board –based support for composting and recycling through the 'Garbage is money' poster campaign along with continual participation in environmental and community events throughout the city.

5.3 Areas for further study

The role of solid waste campaigns in improvement of waste management in Makindye Division, Kampala District.

The role of Education in careful disposal of waste in Makindye Division, Kampala District.

The feasibility study of poor solid waste management practices on community wellbeing, Kampala district.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE TO THE RESPONDENTS IN, MAKINDYE

INTRODUCTION

Dear respondents my name is wire Nicholas student from Nkumba University pursuing a master's degree in environmental health. Am carrying out a research on Effect of solid waste management practices on the local people's general health: A case study of Makindye Division, Kampala Uganda.The information given herein will be treated with absolute confidentiality for only academic purpose

PRELIMINARY INFORMATION

a) Date of interview .....

b) Questionnaire No.: .....

c) Name of Parish: _____

Respondent Selection: I need to speak with member of the household above 18 years of age

SECTION B: DEMOGRAPHIC CHARACTERISTICS: USE A TICK TO MARK THERESPONSE

1. Age of respondents

Age category	**Response (Tick)**
a) 15-19	
b) 20-24	
c) 25-29	
d) 30-34	
e) 35-39	
f) 40-44	
g) 45-49	
h) Above 50	

2. Gender of respondents

Sex	**Response (Tick)**
a) Male	
b) Female	

3. Marital status of respondents

Marital status	**Response**
a) Single	
b) Married	
c) Widow	
d) Separated	

4. Education level of respondents

Education level	**Response (Tick)**	
a) No education		
b) Primary		
c) Secondary		
d) Tertiary		
e) Others (Specially)		

5. Length of time spent in Makindye

Period (years)	**Response**
a)6months-12months	
b)1year-11/2years	
c) 11/2years-2years	
d) 1 ½ years-2years	
e) 2years-2 1/2years	
f) Above 2 1/2years	

SECTION B: NATURE OF SOLID WASTE GENERATED IN MAKINDYE ,

1) Is there any solid waste generated in Makindye division ?

a) Yes

b) No

If yes, what the nature of the solid waste generated?

a) Carton and paper
b) Yard trimmings
c) Food scrap
d) Plastics
e) Metals
f) Wood
g) Glass
h) Textile/ clothing
i) Others (Specify.....)

2) From the above nature of the solid waste generated, what are their common examples? (Choose one response and Tick appropriately)

i. Carton and paper

a) Serviest.
b) Paper bags
c) Paper boxes
d) Newspapers

ii. Yard trimmings

a) Grass
b) Ornamental
c) Tree branches
d) Flowers

iii. Metals

a) Folks

b) Spoons
d) Saucepans
e) Nails
f) Tins/ cans

iv. Plastics

a) Polythene bags
b) Plates
c) Cups
d) Mineral water bottles
e) Pens
f) Basins
g) Jerry cans

v. Glass

a) Bottles
b) Plates
c) Cups
d) Window glass
e) Ceramics

3. From your view, is there any other nature of solid waste generated in makindye division?

a) .....
b) .....
c) .....
d) ....
e) ....

SECTION C: PRACTICES EMPLOYED BY MAKINDYE RESIDENTS TO MANAGE SOLID WASTE

1. **Do you have any practice in place to manage solid waste?**
    a) Yes
    b) No

    If yes, which of the following practices is employed by MAKINDYE DIVISION to manage its waste?
    a) Reuse
    b) Recycle
    c) Reduction
    d) Energy recovery
    E) Dumping

2. Please describe how your household **stores** the garbage from your house.
    a) Closed Container, please describe:
    b) Open Container, please describe:
    c) Plastic bags
    d) Pile in the yard
    e) Other, specify:
    f) Don't Know

3. **From your view, what are the other practices employed by Makindye division in solid waste management?**
    a.....
    b.....
    c.....
    d.....
    e.....

4. Please describe how your household **gets rid** of the following types of garbage from your house.

Types of Garbage	Burn	Burry	Garbage Truck		Recycle	Reuse	Compost	Other (Specify)		
			River/ Gully	In yard	On road					
	1	2	3	4	5	6	7	8	9	10
Food waste										
Yard trimmings										
Paper/card board										
Plastic										
Metals										
Glass										

SECTION D: CHALLENGES FACED BY MAKINDYE DIVISION IN MANAGING OF ITS SOLID WASTE

1. Are there any challenges faced by Makindye as it manages its waste?

   Yes

   No

If yes, which Problems are related to poor waste management in Makindye?

a.....

b.....

c.....

d.....

e.....

2. What do you think should be done to improve solid waste management in Makindye and the other areas within Kampala district?

a.....

b.....

c.....

d.....

\

-SECTION E Environmental Health

1. Are some of the management practices carried out having impacts on human health?

……

……

……

2. What are some of the diseases associated with poor solid waste disposal/management in Makindye division?

……

……

……

2. How can Prevention and control of environmental health diseases related to Solid Waste management be done?

……

……

……

3. What kind of **toilet facilities** does your household use?

Water closet linked to sewer main
Water closet not linked: Absorption pit Septic Tank Other
Pit Latrine: Conventional VIP VIDP
None
Other, specify:
Don't Know

a. Are the toilets facilities used only by your household, or do your share the facilities with other households?

Exclusive use 1	Shared 2

Please specify the number of other households using the facility_____

4. What is the main source of drinking water for your household?

1	Water piped directly into house or yard (public supply)	5	Well
2	Water piped directly into house or yard (private tank)	6	River, lake, spring, pond
3	Public standpipe	7	Rainwater (tank, drums)
4	Wayside tank	8	Other, specify:

5. Are disease vectors or breeding sites present or observed (like, rodents and Mosquitoes) ?

Yes 1	No 2

a. if yes want can be done to prevent them?

……

……

Solid Waste Management Attitude Scale

3. For the following statements, please tell me whether you agree, disagree, or you have no opinion.	No.	Agree	Disagree	No opinion
I play an important role in the management of garbage in my community.	1			
Environmental education should be taught in schools.	2			
The purchase decisions that I make can increase or decrease the amount of garbage my Household must get rid of (dispose of).	3			
I don't care that burning garbage can be bad for my health and the health of others.	4			
People throw garbage on the streets and in the drains and gullies because they have no other means of getting rid of (disposing of) their garbage.	5			
Makindye division is not doing enough to fix the garbage problem.	6			
Correct garbage management should not be taught in schools.	7			
Regular collection of garbage is the only solution to the garbage problem.	8			
Picking up garbage around my community is my responsibility as a Makindye resident.	9			
Public education about proper solid waste management is one way to fix the garbage crisis.	10			

APPENDIX 2: QUESTIONNAIRE TO THE RESPONDENTS [Key Informant] IN, MAKINDYE

1. What are some of the diseases associated with poor solid waste management practices employed in Makindye division?

……

……

……..

2. In your own views state how poor solid waste management practices in Makindye affect the environment and an example of the practices?

……

……

……

3. Which challenges do you face in Makindye division while managing its solid waste?

……

……

……

4 What are the rules and regulations guiding waste management in Makindye?

……

……

……

5. How are communities involved in issues pertaining solid waste management in Makindye?

……

……

……

6. Who are responsible for solid waste collection and garbage management in Makindye division?

……

……

……

7. Is there any improvement in technology to manage solid waste in Makindye division?

……

……

8. Is solid waste collection a free service in KCCA to residents?

(a) Yes (b) No (c) Not sure

If your answer is No in 8.b above, how much on average do one household spend per month on solid waste collection?

(a) 5000 – 10000/- (b) 15000-20000/- (c) 20000-30000/- (d) More than 30,000/-

If your answer is yes, how are the garbage containers spaced?

(a) Less than 100 meters (b) 200 m to 500 m (c) 500 m to 1 km (d) 1 km to 2 km

(e) More than 2 km (f) others please specify ……

9. Have you observed any good practices in KCCA on how they are managing solid waste like in collection, transportation, treatment and disposal?

(a) Yes (b) No (c) Not sure

If your answer is Yes above please state any of the good practices

……

……

……

10. Does KCCA have enough solid waste collection and management facilities &equipments?

(a) Yes (b) No (c) Not sure

If your answer is No above, what among the following do you think explains this?

(a) Lack of funds (b) Lack of capacity (c) Poor management d corruption

Thanks for your patience to me, may the Almighty bless you