OCCUPATIONAL HEALTH RISKS AMONG SOLID WASTE HANDLERS IN NAIROBI COUNTY

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DECLARATION

This project is my original work and has not been presented for an award in any other institution of higher learning.

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DEDICATION

I dedicate this research project to my family who have constantly encouraged me throughout my academic struggle until I achieved my cherished academic dream.

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ABSTRACT

This study analyzes and quantifies the occupational health risks faced by those who handle solid garbage in Nairobi County. Despite the numerous worries raised about the potential harm that trash could cause to the environment and the general populace, occupational hazards in waste management have received little consideration in terms of risks and associated costs in the rush to adopt or embrace technology like composting. The study findings were presented using a descriptive research design. Percentages, means, standard deviations, and frequencies were prepared for presentation as a result of the quantitative analysis of the collected data using SPSS. The qualitative component consists of in-person interviews, open-ended surveys, and field observations. 79% of the respondents were men, whereas only 21% were women. The study's key conclusions showed that human waste, toxic paper, empty containers holding chemical waste, including heavy metals in batteries, solvents, and traces of medical waste such injections and soiled bandages are among the hazardous wastes in the informal enterprises in Nairobi County. Skin infections, diarrhea, and coughing, according to the majority of respondents (89%), are signs of diseases associated with solid waste management. Additionally, a major issue and obstacle to efficient countywide solid waste management is the inaccessibility of sites for trash service providers. According to the report, hazardous waste includes items like human waste, paper and containers that include poisons or chemical residues, medical waste, and heavy metals found in batteries. The study found that insufficient funding, poor infrastructure, and outdated technology, together with the inaccessibility of locations to waste service providers, pose substantial obstacles to the county's successful solid waste management. The study recommends awareness campaigns on 4R’s; Rethink, Reduce, Reuse, Recycle) as a method of solid waste management and mandatory source separation in Nairobi County, the public authority ought to likewise have the option to give workshops to the unskilled workers and show them how to exploit the waste for livelihood while protecting themselves from occupational health risks.

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OPERATIONAL DEFINITION OF TERMS

Recycling: Act of converting waste materials or products into new usable products. Recycling is done with the aim of preventing waste, environmental pollution and reduction of the consumption of new materials.

Waste: substances or items that are discarded because its original user no longer needs them.

Waste management: a field of study focused on the production, management, storage, selection, transportation, and disposal of waste.

Public training: The involvement of citizens in normal garbage collection activities and their awareness of solid waste management, since they should be aware of their duties.

County by-laws: It is a regulation or law put in place by the county government to govern itself, as permitted or mandated by a higher authority. The level of control that the by-laws may exert is determined by the higher authority, which is typically a legislature or another governmental body.

Urban Centre: an expansive urban area with a high population density that may include multiple separate administrative areas.

Specialist: a person highly skilled in a specific field.

Squander: Waste.

Solid Waste Handlers: Refers to the people who manage, store, collect, transport, treat, utilize, process, and manage final disposal of solid wastes.

Decomposition: the state or process of rotting; decay.

Decommission refers to stopping use, decontaminating a facility to reduce its future environmental or public health impact.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Many nations worldwide experience various challenges in the management of solid waste. Such challenges vary from reducing waste generation, separation, collection, change of habits, reuse, transport, disposal and treatment of the same waste. According to the United Nations Environment Programme (UNEP, 2005), the challenges are mainly diverse for dissimilar levels of industrial growth in the country. In a trial to quicken the speed of its industrial development, a nation that is trying to develop its economy might pay insufficient attention to the solid waste management issue affecting the country. Ngoc and Schnitzer (2009) claim that a growing population, different changing patterns of consumption, economic development, varying income, industrialization and urbanization lead to increased waste generation. The known fact remains that solid waste generation will continue to rise yearly if not efficiently managed, and thus it interferes with the service delivery of a county or country (Karanja & Okoth, 2003).

Exposure to unsafe waste can influence human wellbeing, youngsters being more helpless against these poisons. Truth be told, direct openness can prompt contamination and even demise particularly when presented to substance contamination as arrival of compound squanders into the climate prompts synthetic harming. Overseeing solid waste well and reasonably, is one of the vital difficulties of the 21st century, and a

critical duty regarding urban communities and County governments (Schübeler, 2010). It may not be the greatest vote-champ, yet it could turn into a full-scale emergency and a positive vote-washout, if things turn out badly. Most solid waste pickers on the planet are known to pass on in a disturbing rate because of solid waste contamination related illnesses and the captivating interest in solid waste picking is yet on the increase. Squanders in everyday keeps on expanding day by day alongside the connected dangers. In any case, as it stands to date very little has been done, as far as examination study, to reveal what adds to all these, human solid waste related dangers among the general public which is a test that is on the ascent, and which should be managed at the earliest opportunity (Charzan, 2012).

Globally, municipal waste assortment and removal are especially risky in non-industrial urban communities, yet numerous Western urban communities have additionally wrestled with this issue before (and some likely still do). Girling (2015) saw that before the twentieth century, numerous urban communities in Europe suffocated in an ocean of trash with the vast majority of their city solid waste being unloaded into waterways and open sewers. Civil waste administrations were then poor and streams like the Rhine and Thames were just open sewers as they were vigorously contaminated with squander and were significant wellsprings of irresistible illnesses (Girling, 2015). These days, Western nations depend on ashore landfilling to beat the issue of waste gathering (Pacione, 2015). The landfill appears to have a unique fascination for civil waste chiefs since it offers a modest and advantageous choice for garbage removal contrasted with different systems, for example, reuse, and energy recuperation (Charzan, 2012). Truth be told,

except for not many nations like Austria, the Netherlands and Denmark who reuse considerable extents of their waste, most nations in Europe and North America actually dump the main part of their city solid waste in landfills (Organization for Economic Cooperation and Development [OECD], 2012). In this manner, the current prerequisite for nations to climb the waste pecking order stays a genuine test for even the rich and innovatively progressed nations.

An investigation completed in the United States of America (USA) on expanded coronary illness occasions showed that routine waste specialists had multiple times more danger than the nation's overall workers. Due to of lack of comprehension of the size of the issue and poor monetary assets, the dangers are still majorly unmanaged in most agricultural nations. Individuals living and working nearby large waste handling and removal offices are additionally presented to ecological wellbeing and mishap hazards. These dangers identify with the outflows from the solid squanders, the contamination control measures used to deal with these emanations, and the general security of the office (Pellow, 2014). Likewise, with waste related dangers, these dangers are in effect generously overseen in big league salary nations, yet are still generally unmanaged in most agricultural nations. Contamination control costs cash and adherence to safe plan guidelines requires a guarantee to development and activity oversight. Outside monetary help is expected to help helpless nations in their ecological endeavors, despite the fact that solid burn through projects have demonstrated to be additional tedious to get ready and execute than most metropolitan framework upgrades (Medina, 2013).

Regionally, Sub-Saharan Africa is one region where this experimentation is effectively happening now, particularly after the 1980s financial emergency, which brought about expanded difficulty for a large portion of the locale's poor. The major issues, which defy African urban areas because of the 1980s' financial emergency, have been very much reported (Stren & White, 2012). One suffering result is the failure of African governments to support satisfactory degrees of metropolitan administrations. As proceeding with financial difficulty forces an increasing number of citizens to metropolitan territories looking for business, a considerably more noteworthy strain is put on the metropolitan further reducing allocations to waste administration. Monetarily, a city might be not able to give waste assortment services, particularly to the metropolitan poor, the peri-metropolitan or other zones far from the metropolitan core. The metropolitan poor are left to fight with garbage removal all alone. The absence of help given to the metropolitan poor in this space has genuine outcomes on their wellbeing and on the metropolitan climate. In this manner, in urban communities of the created scene, the administration of solid squanders is presently an issue of crucial significance to metropolitan maintainability.

In Kenya, the challenge of Solid Waste Management is actually existent in major towns (Gakungu, 2011). The collection systems in the country are unproductive and disposal systems are not ecologically welcoming. Approximately 40% of every solid waste produced in different urban zones such as Nairobi County is often not collected and less than 50% of the entire urban population is offered the services, (Kenya National Bureau of Statistics [KNBS], 2010). Approximately 80% of available collection transport

equipment of the country is considered to be out of service or require repair and maintenance, thus if the subject of workable solid waste management in country is not well thought-out straightaway, all the counties in Kenya including Nairobi will continue to be overwhelmed with waste. A study on how people, such as institutions and various industries manage the waste will actually help in guiding good practices that can lead to lowered amount of municipal waste in Nairobi County and in effect reduced environmental pollution (Mariera, 1996). Regardless of where everyone lives, works, or plays, people do generate trash. From the beginning of manhood, human beings have always produced waste. Nevertheless, disposal of waste was not an issue when there was nomadic life; different persons just moved away leaving their generated waste behind. During the 10,000 BC, people started to leave their nomadic life and live in societies as two groups of people. With the arrival of non-transient group of people came garbage and waste that were released on the ground where human beings existed. Alternative methods of waste disposal were not established till waste started to put at risk the life of people in the city and its environs (Khan & Ghouri, 2011).

Urban areas in Kenya produce a sizable amount of solid trash annually. In fact, it has grown to be a significant environmental and public health hazard. Similar to other Kenyan urban centers, Nairobi's solid waste management (SWM) status is typically characterized by low solid waste assortment, contamination from uncontrolled waste unloading, wasteful public administrations, unregulated and awkward dump areas, a lack of essential solid waste administration foundation, and a complete disregard for worker safety and health. NEMA estimates the solid waste generation rate in Nairobi city at

2,400tons per day while Allison (2010) predicted the daily generation at 4,016 tonnes. Both Nairobi City County waste collectors (formal) and private waste collection companies including community-based volunteer groups collect an estimated 60% of the waste. An estimated 45% of garbage is retrieved along the waste stream, with a higher percentage recovered at the primary disposal location, the Dandora dumpsite. The methods used in Nairobi City to handle solid waste, including storage at the source, collection, transport, disposal, and recovery, pose serious threats to human health and safety as well as environmental contamination.

The risks will continue to increase as the urban population increases and as their economic status improves. Those who will bear the brunt of this urban population increase and social-economic status improvement are the solid waste collectors and the recyclers/pickers who will have to handle increasing quantities of municipal solid waste, industrial waste and hazardous waste. The solid waste collectors and informal recyclers are vulnerable informal settlement dwellers typified by poverty, homelessness and underemployment and are a population group at risk for exposure to physical injuries and waste hazards (Rotich, 2015). Even though the human risks of injuries and diseases and the associated monetary costs to vulnerable households in Nairobi city are high, information available to public health practitioners is hardly enough for use in drawing stakeholder attention to reduce such risks. Solid waste recycling is a source of much-needed income for a large population of informal settlements' dwellers in Nairobi.

However, solid waste handling is often unsafe due to among others non-segregation of waste at source, application of rudimentary and uncontrolled collection, recovery and processing methods and non-compliance with occupational safety and health regulations. This often results in not only contaminated environments but also exposes the vulnerable collectors and recyclers who include women and children to harmful chemicals and injuries. While many of the occupational tragedies are preventable through the implementation of sound prevention, reporting and inspection practices, statistics on occupational diseases and injuries among waste collectors and informal waste recyclers are scarce and the occupational hazards facing them has not yet received the attention it deserves in research, public health agendas and at national and county government levels.

Nairobi is considered as the main industrial Centre in Kenya (Mwenda et al., 2018). The railways are the principal distinct industrial employer. Various light manufacturing industries also help in the production of beverages, processed food and cigarettes. Tourism is likewise significant. Due to its proximity to Eastern Africa's agricultural heartland, Nairobi City serves as a conduit for a variety of primary goods before they are shipped via Mombasa. As the headquarters and operational hub of important regional railways, airlines, harbors, and enterprises, Nairobi consequently plays a crucial role in the communities of Eastern African nations. Nairobi is among the fastest growing municipalities in Africa, rapidly becoming the second leading city of the African Great Lakes region (Nairobi Population, 2017). The city is rising at a rate of more than 4% yearly, chiefly for the reason that there is high birth rates and various immigrants that

come to the city in search for employment openings (Urban ARK & African Population and Health Research Center [APHRC], 2017). It is projected that Nairobi City will progress to be on its skyward trajectory in terms of population, approaching 5 million by 2025. Nairobi City is the site of one of the biggest slums around the world, and roughly 22% of its inhabitants live in poverty. Domestic waste accounts for 68% of the total waste produced in Nairobi, according to a report by the National Environment Management Authority and the United Nations Environment Programme, while various non-domestic waste from industrial, road, market, and other activities has contributed to about 32% of the total waste produced. This is sub-divided in the following ways: Industrial activities at 14 %; road activities at 8 %; hospitals activities at 2 %; markets activities at 1 %; and other sources at 7 % (Ngau & Kahiu, 2009; UNEP & National Environment management Authority [NEMA] 2003).

Similar to other emerging regions, rapid population growth and the expansion of manufacturing and service industries in various African cities has led to an increase in the amount of solid garbage produced, despite the fact that waste management standards have remained appalling. This is especially true in underdeveloped areas like slums where there is little to no garbage collection. Uncollected waste is then improperly disposed of, usually next to urban informal residential areas, usually in open landfills or dumpsites. The combined literary works thoroughly acknowledge the impacts of insufficient SWM in cities and major municipalities on the environment and public health, as well as potential adverse repercussions on every citizen's quality of life (Urban Africa Risk Knowledge & African Population and Health Research Center, 2017).

Therefore, the purpose of this study is to evaluate the extent of occupational diseases, illnesses, and injuries among solid waste collectors employed by the Nairobi City County government and unofficial recyclers at the Dandora dumpsite in Nairobi.

1.2. Statement of the Problem

Efficient waste management systems are essentials in order to ameliorate the negative effects of economic as well as social development. However, most countries around the world are unable to maintain adequate waste management systems capable of handling the continuously growing mountain of waste that is generated. This is due to inefficient collection systems. Without collection, waste cannot be disposed off, treated or reused. On the other hand, failing to collect waste leads to environmental and social-economic repercussions (Regassa et al., 2011). The concentration of populace and business activities in the towns is being joined by a quick expansion in the volume of solid waste created from creation and utilization exercises (Girling, 2015). Against the present circumstance of mounting waste creation, city experts in the region appear to be not able to sort out satisfactory assortment and safe removal of waste inside their purviews, regardless of their great exertion of attempting to guarantee the equivalent is dealt with. Thus, metropolitan settlements in the districts are burdened with a demolishing solid waste circumstance, which ends up being immovable and undermines general wellbeing and the climate. A quick perception inside the towns shows noticeable parts of the solid waste issue including aggregation of trash, weighty road litter; squander obstructed depletes and water bodies and smelling drains (Rotich 2015).

In spite of the worries as often as possible raised by concerned gatherings, foundations and people among the general population, the solid waste circumstance in the metropolitan places keeps on declining, consequently presenting genuine dangers to general wellbeing and the climate. In addition, the ecological weights related with the demolishing solid waste circumstance seems to fall all the more intensely on the poor despite the fact that waste expulsion and removal are public subsidized and directed (Stren & White, 2012). The term solid waste management describes a variety of manual tasks that put solid waste specialists in close proximity to rubbish or squander. In Kenya, solid waste controllers have been exposed to a large number of occupational accidents and illnesses due to the various waste specialists' reluctance to adopt modern waste management procedures and their inability to manage garbage.

The main focus is illegal dumping and overflowing garbage containers, and refuse removal in Kenya isn't actually in conflict with the schedule for waste collection to the extent that rubbish goes uncollected for a long period. Waste professionals are required to manually remove, shovel rubbish, and lift heavy, overburdened containers (Girling, 2015). Workers who manage solid waste are exposed to high levels of physical, chemical, and organic toxins emanating from landfills. Additionally, due of staff shortages, trash specialists are assigned tasks that are beyond their capacity, which leads them to accomplish their tasks outside of the established waste management processes and exposes them to unavoidable risks.

Further along this line, waste collectors frequently disregard the proper use of personal protective clothing and are unaware of the hazards the rubbish they handle poses to their safety and wellness. The current waste management systems in Nairobi indicate a serious risk of interaction with solid waste hazards. In any case, despite extensive studies on waste management, the origins and type of illnesses and injuries at the Nairobi County dumpsite have not been examined. At the global scene, Wilsonet al. (2012) deduced that majority of dump sites were not subject to any control or monitoring by the Ministry of Health as well as other ministries. Hoornweg and Bhada-Tata (2012) reasoned that municipal solid waste management is the greatest significant service any city can offer both in low-income countries and middle-income countries. Guerreroet al., (2013) and Zerbock (2003) did some studies to find out ways of disposing wastes in urban regions. They discovered that in urban centers all over African countries, approximately half of the solid waste produced is mostly collected, and 95% of that quantity of waste generated is either comprehensively thrown away at different dumpsites on the outside edges of the urban centers, or at various purported temporary spots, normally empty lots spread all through the city. Locally, Kukreja et al., (2009) investigated the cause of flooding in Nairobi County. One of the reasons he came up with is that the dumpsites, which are not, controlled causes obstruction of the drainage systems therefore leading to flooding. Purvis (2015) investigated the presence of licensed dumpsites in Nairobi, and he found out that Nairobi County does not have licensed or selected dumpsites therefore, it is very common to see animals like cows, chicken, pigs and goats feeding at such dumping sites. The sites are usually littered and

are thus breeding places for various disease-causing bacteria and viruses. African Population and Health Research Center -APHRC (2017) lately examined the various integration levels of Solid Waste Management (SWM) in Kenya, and ways in which such policies chiefly address issues of health amongst urban inhabitants in Mombasa and Nairobi. They nevertheless did not look at the social changing aspects of SWM. The authors contend that there are comparatively good provisions for SWM put in place in Kenya. For instance, in relation to macro-level incorporation, the authors reason that the National Environment Policy that plans tasks for the state is well incorporated with the National SWM policy, which is highly considered to be policy for action amid various stakeholders.

The above studies concentrated on the theoretical approach on SWM in Kenya overlooking the practical section of SWM and its impact on Health in Nairobi, Kenya. This research was done to bridge the existing knowledge gap on SWM in Nairobi County. Therefore, the aim of the research was to identify the occupational health risks among solid waste handlers in Nairobi County.

1.3. General Objective of the Study

The general objective of the study was to identify /determine the occupational health risks among solid waste handlers in Nairobi County.

1.4. Specific Objectives

The study was guided by the following research questions:

i. To identify the types of waste that are hazardous to solid waste handlers in Nairobi County

ii. To determine the common diseases, among solid waste handlers in Nairobi County

iii. To find the occupational challenges experienced by solid waste handlers in Nairobi County

iv. To establish the risks associated with solid waste picking among solid waste handlers in Nairobi County

1.5. Research Questions

The study answered the following research questions:

i. What are the various types of waste that are hazardous to solid waste handlers in Nairobi County?

ii. What are the common diseases, attributable to the solid waste management among solid waste handlers in Nairobi County?

iii. What are the occupational challenges experienced by solid waste handlers in Nairobi County?

iv. What are the risks associated with solid waste picking among solid waste handlers in Nairobi County?

1.6. Justification of the Study

In Kenya, little attention has been paid to the dangers to occupational health and safety that come with managing trash. Due to the current financial crisis, most local governments are working to eradicate actual garbage in order to protect the environment and public health, making it difficult to protect waste controllers from workplace hazards (Stren & White, 2012). Additionally, the removal of mixed wastes is actually made possible by waste management procedures to the point that it is common for domestic waste to be mixed with hazardous and clinical waste, increasing the risk to solid waste workers, the general populace, and environmental contamination. This has necessitated conducting the current inquiry to learn more about the relevant health risks among officials and solid waste recyclers.

The study may be important to Nairobi County because it discussed the work of the agencies responsible for waste management in Nairobi City and its environs, which resulted into detecting key challenges of SWM as well as proposing possible solution. This research may also help in determining how Health is influenced by solid waste management as well as suggesting areas of development for a Healthy Environment in the county. To other counties and regions, this research study was significant because it will contribute to policy formulation on how waste should be managed to minimize its effects on Health. As a result of this study the policy makers in other counties can utilize the findings as well as recommendations to achieve better ways of managing wastes in their respective counties in Kenya. To future researchers and academicians, the study

findings may act as a reservoir for knowledge and provided the basis for further research on impact of SWM on health of waste handlers.

1.7. Limitations of the Study

The researcher encountered some challenges in clearing misinformation among the solid waste handlers at the Dandora dumpsite who felt that the the researcher was collecting the information to raise funds to benefit self. The researcher, however, overcame this by displaying his student identity card and informing the study respondents that the data will be used solely for academic purpose and that utmost confidentiality will be maintained. The research permit authorizing this research and introducing the researcher to the stakeholders also played a major role in addressing this limitation. There was some phobia and unavailability of the respondents during data collection exercise. The researcher addressed this by giving the respondents enough time to answer the questionnaires, carrying out follow up courtesy calls to respondents to collect filled questionnaire. The purpose of the study was briefly explained to the respondents before administering the questionnaires to reduce cases of non-response. One is the challenge of resources which limited the collection of information particularly where the respondents demanded the physical presence of the researcher leading to increase of travelling expenses. Incidents counts on some diseases are considered confidential thus it was difficult to get the whole data but this was bridged by getting data from secondary sources.

1.8. Delimitations of the Study

The study focused on establishing the occupational health risks associated with solid waste pickers in Nairobi County and specifically, to identify types of waste that are hazardous, to identify the common diseases, attributable to the waste picking, to establish the prevalence of diseases among the waste pickers, and to occupational challenges experienced by solid waste handlers. The study was done in Nairobi County with an assumption that the findings would be applicable to other sites.

1.9. Significance of the Study

The findings of the research will profit the County administration of Nairobi to build up on the SWM framework to wipe out the safety and wellbeing hazards faced by operators in the solid waste continuum of handlers. Due to increased productivity, decreased absenteeism, lower compensation costs, and ultimately benefits to the general public and climate assurance, this will enhance the administration's accomplishments (Schübeler, 2010). The study will help the top management understand the health hazards associated with solid waste handlers, and understanding these risks can aid them in making decisions that will effectively minimize the risks faced by solid waste handlers. This will involve reviewing the current safety and security measures, garbage collection practices, and consequently taking into account complications such disposal risks and administrative controls. The implementation of simple personal protective apparel and materials on-site, acceptance of county representatives, pre-medical exams, information sharing about dangers on-site, and immunization program promotion are a few examples of these management measures.

The study's findings will aid policymakers in developing a passion for the associated risks faced by solid waste workers to the point where they collaborate with the top administration on carrying out interventions, such as allocating adequate resources toward wellbeing and thereby improving working conditions. The investigation is crucial because it will highlight the risks associated with waste collection for the Kenyan government, businesses, neighborhood, health, neighborhood-based associations, recyclers, and waste experts (Charzan, 2012). The identification of waste-related risks will inform the concerned waste workers to abide by given norms of practice, ensuring their welfare and a safe workplace. The research findings will also help other local professionals plan and carry out security and safety measures, particularly for those who work with solid waste.

The results of this study will fill in certain information gaps and add to the body of knowledge about the dangers to waste handlers' health and welfare. The findings will therefore be subject to peer review, which will be extremely advantageous for individual researchers as it will provide justification for further research on related risks among garbage specialists (OECD, 2012). The investigation will be extremely beneficial to the researcher because it will provide detailed knowledge on the health and safety risks associated with rubbish. The study will assist waste managers in learning practical knowledge on the role that waste management frameworks and waste managers play in preventing hazards associated to waste.

1.10. Assumptions of the Study

The project report was built on the presumption that the records and data gathered during the survey accurately represented the state of the study's operations. The sample population chosen for data analysis was also thought to be an exact replica and representative sample of the entire Nairobi County. The study also made the supposition that the respondents provided accurate and truthful responses to the survey questions and that they were readily available.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The study's literature review is presented in this chapter. It connects earlier research, investigations, and their conclusions. This chapter primarily focuses on the occupational health risks connected to collecting and recycling solid waste among collectors. Additionally, the theory and conceptual framework for the study are explored in this chapter.

2.2. Solid Waste Management in Urban Areas

According to Adeniran et al. (2017), solid waste is any trash or junk that results from human or animal activity and is discarded because it is unwanted or useless. A region's primary sources of solid waste are residential, commercial, and industrial activity, which can be managed in a number of ways. Thus, landfills are characteristically categorized as municipal, sanitary, construction and industrial or demolition waste sites. Solid waste can be characterized centered on material, like plastic, glass, paper, organic and metal waste. Classification might similarly be centered on hazard potential, which include radioactive, flammable, toxic, non-toxic or infectious waste. Classifications may perhaps relate to the waste origin, like industrial, commercial, domestic, demolition and institutional or construction.

According to the Arab Reporters for Investigative Journalism (ARIJ ,2009), waste that is produced on the streets build unfriendly smells and is mainly form the breeding sites for

insects and vermin that results to diseases; hazardous resources from aimlessly and erroneously discarded waste can leak into and contaminate resources of water, which include groundwater or any main drinking water source. Thus polluted earth as well as water get into the body of human beings, through drinking water, animal products and vegetables, whereas burning the solid left-overs contaminates the air, leading to severe health issues, which include respiratory diseases, cancer, and other diseases. Irrespective of the starting point, hazard or content potential, every solid waste needs to be systematically controlled to guarantee ecological best practices. Since solid waste management is a life-threatening feature of environmental sanitation, it must be assimilated into the environmental planning agenda.

Since the hours of the modern unrest, business possibilities in metropolitan zones have consistently affected country metropolitan relocation, which has been the primary driver for metropolitan populace development. The yearly metropolitan territories populace development rate surpasses 4% in many nations (United Nations Human Settlements Programme [UN-HABITAT], 2010). With quickly progressively populaces in urban communities came a tremendous test in help conveyance like solid waste administration, a test that has kept on overpowering numerous legislatures and metropolitan specialists particularly in the creating scene.

Larger part of the neighborhood governments burns through 20% to 40% of their incomes on solid waste administration however, they cannot stay aware of the developing issue (UN-HABITAT, 2010). As per the World Health Organization,

governments in non-industrial nations ought to focus on medical problems dependent on natural concerns (WHO, 2010). In general, in developing nations, under 30% of metropolitan zones have appropriate and normal trash assortment and removal frameworks (Onibokun, 2009).

Local governments frequently leave the capacity of waste administration to separate nearby specialists, which regularly come up short on the imperative ability to adapt to the assistance requests of quickly developing populaces. As such, metropolitan experts in most non-industrial nations just come up short on the specialized and infrastructural assets needed to go up against the waste administration issue (UNEP, 2007). The lack of limit in local specialists is typically caused by flimsy and ineffective waste management systems, in which little or no effort is diverted. Frameworks for managing solid waste are designed to collect, store, manage, transport, process, and arrange solid wastes in a way that is environmentally sound (ensures biological systems), socially acceptable, and economically beneficial. In North America and Australia, acceptable solid waste management has been taken into account; it mostly consists of landfills and recycling techniques. (Reddy, 2011).

Municipal solid waste management creates one of the highest critical service delivery challenges that face the African cities and towns (Achankeng, 2003). Thus, various economic melt-down that Zimbabwe underwent throughout the 10 years, between 2000 and 2010 led to several challenges being influenced against all-encompassing urban operational Solid Waste Management. Such challenges comprised of the incapability of

the municipalities to source for non-toxic water to the inhabitants, incapacity to dispose off sewage as well as the breakdown of service delivery and infrastructure in Solid Waste Management (SWM) activities from production of waste, storage, collection, and similarly safe disposal of the same waste. SWM is well-defined as the activity related to control of production of solid waste materials, collection, storage, transfer or transport, processing as well as disposal of the same waste in various means, which best address the issue of public health, economics, conservation, engineering, aesthetic and other environmentally friendly concerns.

2.3. Types of Waste that are Hazardous to Solid Waste Pickers

In terms of waste management, the waste system, the job duties (assortment, transport, and reusing), and the type of hardware utilized all have an impact on the exposure to work-related dangers. The synthesis of waste, the idea of waste and its biodegradability, the methods for treating waste, the waste preparation processes that are utilized, and their removal, according to Cointreau (2006), govern the health risks inevitable to either the specialist or tenants surrounding waste offices. Although non-industrialized nations often experience low levels of economic activity, this does not mean that their solid waste is devoid of hazardous pollutants that pose serious health dangers to both the general public and solid waste personnel.

Workers who handle solid waste are at risk for health problems related to their jobs because of wastes such human feces, poisonous paper, pesticide deposits in trash cans, solvents, and small amounts of clinical waste like infusions, soiled cloths, and heavy

metals in batteries. The Zimbabwean Environmental Management Act Chapter 20:27 defines dangerous waste as any substance that is poisonous, mutagenic, teratogenic, inflammable, responsive, touchy, destructive, and also irresistible. Waste isolation is not regularly done in non-industrialized nations, and as a result, filthy gauzes, wasted cotton fleece, and spent infusions from medical facilities are frequently found mixed in with residential solid waste (Rushton, 2003).

Hazardous solvents, glues, plating materials, pesticides, asbestos-containing materials from construction and demolition projects, cleaning products, personal care items, automobile products, insecticides, herbicides, and a variety of batteries and sharps, like broken china, are among the waste stream's other components (Jerie, 2016). The collection of mixed garbage is permitted by the solid waste management systems in non-industrial nations like Zimbabwe, for instance, raising the health concerns caused by the numerous toxic synthetics. For instance, considerable levels of metals like mercury, cadmium, chromium, lead, and arsenic can be found in electronic waste (Jerie, 2016). Because these heavy metals are naturally neurotoxic and carcinogenic, they are associated with a number of health hazards (Van Eerd, 1997).

Inorganic arsenic is linked to illnesses like lung, kidney, bladder, and skin issues because of its capacity to cause sickness. Waste materials including polyvinyl chloride, cleaning product containers, and zinc batteries frequently contain cadmium. The body's internal systems, including the liver, kidneys, lungs, bones (which can cause osteoporosis), the brain, and the primary sensory system, are all negatively impacted by the huge quantity

of metal that bio-accumulates there (Jerie, 2016). The same inventor claims that ingestion of harmful substances by accident through the skin, air, or bloodstream might hasten the development of cancer, cause birth defects, and cause casualties. The properties of combustible wastes can be determined using low-glimmer, readily landed focuses. Destructive waste are intended to eat and destroy biological and non-living tissues when they come into contact with them.

Mercury traces may be present in batteries, fungicides, and pharmaceutical disposal containers. The heavy element mercury has an especially bad effect on the nervous system. Some pesticides are resourceful by nature and have the potential to cause long-term harm, significant adverse effects, and ecological devastation. Biodegradable waste makes up a sizable component of solid waste. Food scraps and vegetable trash are examples of wastes with low lignin content that break down more quickly than wastes with high lignin concentration, such as paper and plastic (Jerie, 2016). the vast majority of biologically degradable substances in illnesses treated with natural remedies and waste (Tchobanoglous, 2003). Rats and mice may live in biodegradable wastes, which also contain a lot of organic bacteria that cause sickness (Joseph et al., 2016).

2.4. Common Diseases, Attributable to Solid Waste Management

Nosocomial contaminations in patients from helpless diseases control practices and helpless waste administration. Ill-advised administration of waste created in medical care squanders causes an immediate effect on the local area. Biomedical squanders produce three sorts of contaminations created noticeable all around as organic, synthetic

and Radioactive (Loboka et al., 2013). Indoor air poisons as the microorganisms noticeable all-around cause helpless ventilation. The contamination because of biomedical squanders relies upon record of the air, soil, water. The radioactive emanations and radioactive squanders through exploration and radio-immunoassay exercises produce little amounts of radioactive gas in the mechanism of air.

Toxins causes the tainting of air as the source being transmitted at an open surface where biomedical squanders breed vermin and bugs, mosquitoes, and so forth send creepy crawly borne sicknesses like Malaria and filarial, regular house flies communicate contaminations precisely (Onibokun, 2009). The Soil is the medium where sharps and different squanders are arranged by the land internments and so on wealthy in lockjaw spores or blood borne microbes have acquired the critical assault of HIV, HBV, HCV which prompts AIDS and Hepatitis B, C and other viral and bacterial diseases.

There are four essential ways that an individual can be presented to contaminations through the skin, through mucous, layers in the eyes, nose and mouth; by breathing in irresistible specialists and by gulping them (UN-HABITAT, 2010). For Example, Specific dangers to landfill laborers from clinical squanders that has caused most general wellbeing worries of contracting hepatitis B, AIDS from needle stick or from tainted blood or blood staining liquids being sprinkled or scoured into open injuries, non-flawless skin, or mucous layers. Medical clinic squander is a potential wellbeing risk to the medical services laborers, public and verdure of the space. The issues of the garbage

removal in the medical clinics and other medical services establishments have become issues of expanding concern.

Incapable rubbish collection and helpless waste management have numerous negative effects. Genuine difficulties with people's and the environment's health are caused by a lack of variety and hapless eradication practices (Loboka et al., 2013). For instance, forced removal drills have exacerbated health-related difficulties in Sub-Saharan Africa (Zhu et al., 2008). Abul (2010) found that dumpsites were in filthy, unsightly conditions. Additionally, it has been found that the negative effects are even worse in the late spring when the extreme temperatures hasten the response of microbes and bio-corruption. According to Collivignarelli et al. (2014), improper collection, removal, reuse, or treatment of solid waste poses severe risks, including health risks and environmental contamination. According to studies by Zhu et al. (2008) and Sharholy et al. (2008), inefficient garbage collection methods and poor solid waste management are a factor in regional water resource contamination, local disease outbreaks, and worldwide ozone depleting substances.

Boadi and Markku (2015) also found that food contamination by flies that have benefited from garbage is linked to a high frequency of loose stools in children under the age of six (Boadi & Markku, 2015). One of the most prevalent outpatient instances is looseness of the bowels, which is assumed to be caused by cleanliness and account for 30,300 passings annually (Domfeh, 2012). Removal of waste into water bodies has shown to be another useless waste administration strategy. According to Aibor et al.

(2016), this contributes to flooding, pollutes the climate, and does everything it can to spread infectious diseases like hepatitis B and C, tuberculosis, yellow fever, West Nile fever, dengue fever, and hemorrhagic fever as well as digestive illness. The practice of "water body-unloading" doesn't portend well for a healthy population and economic success.

2.4. Occupational Challenges Experienced by Solid Waste Handlers

SWM face various challenges when it comes to implementation. According to ARIJ (2009), these challenges comprise of critical funding shortages, and thus the international community has always given the provisions of major facilities and equipment. In the city of Nablus, every new infrastructure as well as major tools has been funded via either grant help or infrequent sponsoring from financial institutions such as the European Commission, and the donor nations. Although such financial support has made significant helps to the unit of waste management at Municipality of Nablus, still the unit is observed to lack various equipment and facilities, which include various types of containers having different functions, colors and sizes. According to UNEP (2005), the challenges are mainly diverse for dissimilar levels of industrial growth in the country. In a trial to quicken the speed of its industrial development, a nation that is trying to develop its economy might pay insufficient attention to the solid waste management issue affecting the country. Ngoc and Schnitzer (2009) claim that a growing population, different changing patterns of consumption, economic development, varying income, industrialization and urbanization lead to increased waste generation. The known fact remains that solid waste generation will continue to rise

yearly if not efficiently managed, and thus it interferes with the service delivery of a county or country (Karanja & Okoth, 2003).

Because of this, many of the devices in use today are obsolete and ineffective. Lack of public awareness and participation may impede proper solid waste management. Lack of awareness and accompanying public ignorance, which are caused by unfavorable waste disposal and trash collection behaviors, continue to be the biggest problems for the entire Palestinian community when it comes to ecological concerns in general and SWM practices in particular. A lack of proper segregation practices exposes waste handlers to serious health risks and increases the scope of those who are vulnerable to those risks, including doctors, nurses, patients, hospital management staff, the general public, and the environment, according to a study by Muniafu and Otiato (2010) that was based on a quantitative analysis of data. Hospital trash is poorly disposed of as a result of incorrect waste segregation, disregard for local and system legislation, and disdain for WHO waste management guidelines. This, according to Muniafu and Otiato (2010), is a direct result of problems with ignorance, lax law enforcement, a lack of process ownership, and gaps in ongoing monitoring of waste management procedures. Muniafu and Otiato's (2010) work on the classification and management challenges of biomedical waste accurately illustrates practical issues to protect biomedical waste handlers while having numerous gaps and methodological faults.

For agricultural country urban regions, the collection, transportation, and removal of solid waste comes at a massive cost: garbage executives typically account for 30 to 50

percent of metro operational budgets. Urban areas only collect between 50 and 80 percent of the decrease produced despite these high uses. For instance, as an agricultural country, India gathers almost 50% of the decrease that is made. Removal is given less thought, although 90% of the MSW collected in developing metropolitan areas ends up in an open landfill (Cointreau 2008). Additionally, residents in areas where low-pay networks are required to pick up refuse tend to either dump their trash in the next open area, spring, stream, or vacant lot, or to literally consume it on their terraces. When it rains, uncollected trash can accumulate on the streets and public spaces, potentially causing flooding. Additionally, run-off water can carry waste to lakes, oceans, and waterways, impacting those areas (Bullard, 2011). Another option is to end up as trash in an open landfill, which is the most common method of removal in non-industrial nations, regardless of whether it is legal or not.

Solid garbage that is unloaded in the open poses unique risks to the environment and human health. Methane gas, which can cause fire and explosions and contribute to changes in the climate and ecosystem worldwide, is produced when natural resources are decommissioned. An open landfill's natural and chemical cycles result in solid leachates, which contaminate groundwater and the surface (Medina, 2008). Additionally, fires do occasionally break out in open landfills, bringing smoke and increasing air pollution. For instance, in Coast, a fire at the nearby open landfill burned for more than six months. At open dumps, flames occasionally break out suddenly, fuelled by the warmth and methane produced by natural decomposition.

Additionally, some metropolitan towns' dump managers willfully set fire to their facilities on occasion in an effort to reduce the weight of the rubbish there, allowing for the placement of additional waste there and extending the life of the dumps (Bryant, 2011). Additionally, human scavengers may start intentional fires because metals are easier to find and recover amid the cinders than they are among piles of mixed waste. To the unloading locations, food leftovers and kitchen waste attract rodents, insects, birds, and other types of animals. People who live nearby may contract diseases from animals being cared for at waste sites. The biodegradation of natural materials may have occurred decades ago, which may limit the use of the area where open dump locations are found in the future (Medina, 2008).

Inadequate training for waste handlers, a lack of monitoring and control systems, a lack of personnel protective equipment during the segregation and transportation of biomedical waste, careless dumping of clinical waste within the noninfectious waste, and exposing workers to the risk of waste hazards (Egondi et al. 2015). From a management perspective, Allison and Von Blottnitz (2010) noted that waste segregation reduces risks to handlers while simultaneously lowering the cost of disposal because some non-hazardous wastes can be recycled or reused, which lowers expenses.

In accordance with a regulatory requirement for waste management compliance, Ahmed et al. (2015) found that 90% of Nairobi County biomedical waste handlers had subpar audit reports with records of work-related incidents. Ahmed et al. (2015) evaluated the record-keeping compliance of 30 firms out of 100 that produce biological waste and

found that 73% did not preserve records to avoid accountability for workers who were at risk of accidents and other working risks. The study found that liquid wastes, plastics, incinerator ash, and injuries from sharp objects like needles and knives were the main sources of infection for diseases including hepatitis B and HIV. According to Parizeau (2015), there are a number of new challenges relating to workplace accidents and accidents at work, such as a lack of information about how to apply preventive measures to human health and contamination from untreated anatomical waste.

Absence of advanced technological capacity for separation of waste at the immediate source is considered as one of the main factors that help in hindering effective SWM. Waste recycling is costly. Even though current years have had a rise in various waste recycling amenities, the recycling economics is still unfavorable. In several cases, waste recycling is costly when compared to purchasing the product. Thus, the support of the government in terms of inexpensive land for landfills and grants are usually essential for profitable practicality. There is also underdeveloped market for the products developed through recycling process. Inadequate demand for the recycled goods in the local market is an additional reason that has hindered the development of the waste recycling business. Therefore, there exists some units taking part in recycling waste plastics, paper and paperboard (Ajani, 2008). The main technical issues that face many cities include, unreachability due to the urban and geographical structure, deficiency of appropriately planned collection time schedule and route system, malfunctioning and inadequate operation equipment. These combined with open garbage burning, poor final dump site

condition and dropping litter at the corner around the waste containers are activities that promote illegal dumping (Sridhar et al. 1985).

Ahmed et al. (2015) found that poorly maintained incinerators, which are frequently in poor operational condition, were the major issues encountered by biomedical institutions. Incinerators must be in good working order to minimize or eliminate risks associated with the workplace, particularly those posed by dangerous compounds such heavy metals and dioxin. Particularly when dealing with biological waste and in situations requiring the treatment of waste, Siddharudha and Sowmyashree (2015) urged that compliance with special equipment handling requirements, including emergency procedures in case of accidents, be necessary (Garg & Sarkar, 2013). The report suggested suggestions for groups to launch training and awareness-raising initiatives for institutions that produce medical waste and biological waste handlers. The Department of Occupational Safety and Health, NEMA, and the Kenya National Biosafety Authority are appropriate entities to carry out such awareness-raising activities (DOSH). When handling trash, mishaps frequently involved bleeding into the nose, open skin, or mucocutaneous damage, which occurs when blood splashes into the mouth (Patan & Mathur, 2015). Additionally, they came to the conclusion that improper handling of various biological waste kinds during collection and disposal greatly increased workplace mishaps.

2.5. Risks Associated with Solid Waste Picking among the Solid Waste Management workers

A variety of dangers associated with dangerous or careless family garbage have been observed among solid waste collectors (Abhay, 2010). Waste authorities around the world have acknowledged business-related problems and injuries. These include problems with the respiratory system, the digestive system, muscular tears, fever, headaches, fatigue, and skin and eye irritation. Other specific types of wounds include mechanical wounds, pneumonic problems, chronic bronchitis, musculoskeletal injuries, hearing loss, and others. The urban population of Ghana's current country includes one of the least fortunate and poorest communities: e-waste laborers. They are frequently exposed to cuts and wounds while working in dangerous circumstances (Alston, 2013).

If residential waste and hospital waste are combined, it could lead to contamination of persons who handle waste with diseases like the hepatitis B virus. Hepatitis is more prevalent, according to the investigation. Infection rates among municipal garbage workers are greater (+) than those in the unprotected population who do not handle waste (Austin & Schill, 2011). The medical conditions that are related to their line of work may be caused by the trash gatherers' exposure to bio-mist concentrations, such as microorganisms and unstable mixtures (such as metabolites and poisons from these microorganisms), when managing waste. Family hazardous waste has a direct negative influence on human health, contaminates groundwater, and raises the possibility of harming natural habitats. Family trash that has been left outside can contaminate the land by leaching chemicals into it (Beasley, 2010).

Inappropriately arranged batteries and fluorescent lights present critical dangers to the climate as portrayed for Brazil. Substantial metal defilement in food item, house dust, ranch soil, and groundwater were found in an e-squander reusing region in China, where work measures are at present not directed (Bryant, 2011). Weak gatherings, presented to family squander borne risks, incorporate waste pickers, city and private waste authorities, little waste brokers, and conceivably inhabitants. Nevertheless, squander pickers are the biggest and weakest gathering, on account of their degree of avoidance and the absence of defensive estimates when working with squander. Openness to aviation routes aggravation and glucan can cause wellbeing dangers and waste laborers, especially squander pickers are influenced altogether, because of unsorted unsafe family squander (Bullard, 2011). Accordingly, family squander authorities and waste pickers are in danger of creating ongoing respiratory manifestations like hack, mucus, wheezing, and constant bronchitis.

Exposure to unsafe waste can influence human wellbeing, youngsters being more helpless against these poisons. Truth be told, direct openness can prompt contamination and even demise particularly when presented to substance contamination as arrival of compound squanders into the climate prompts synthetic harming. Overseeing solid waste well and reasonably, is one of the vital difficulties of the 21st century, and a critical duty regarding urban communities and County governments (Schübeler, 2010). It may not be the greatest vote-champ, yet it has the ability to turn into a full-scale emergency and a positive vote-washout, if things turn out badly. Most solid waste pickers on the planet are known to pass on in a disturbing rate because of solid waste

contamination related illnesses and the captivating interest in solid waste picking is as yet on increment. Squanders increasedaily alongside the connected dangers. As it stands, to date very little has been done, as far as studies to reveal what adds to all these, human solid waste related dangers among the general public. These dangers areon the ascent and should be managed at the earliest opportunity (Charzan, 2012).

The risks will continue to increase as the urban population increases and as their economic status improves. Those who will bear the brunt of this urban population increase and social-economic status improvement are the solid waste collectors and the recyclers/pickers who will have to handle increasing quantities of municipal solid waste, industrial waste and hazardous waste. The solid waste collectors and informal recyclers are vulnerable informal settlement dwellers typified by poverty, homelessness and underemployment and are a population group at risk for exposure to physical injuries and waste hazards (Rotich 2015). Even though the human risks of injuries and diseases and the associated monetary costs to vulnerable households in Nairobi city are high, information available to public health practitioners is hardly enough for use in drawing stakeholder attention to reduce such risks. Solid waste recycling is a source of much-needed income for a large population of informal settlements' dwellers.

However, solid waste handling is often unsafe due to among others non-segregation of waste at source, application of rudimentary and uncontrolled collection, recovery and processing methods and non-compliance with occupational safety and health regulations. This often results in not only contaminated environments but also exposes the vulnerable

collectors and recyclers who include women and children to harmful chemicals and injuries. While many of the occupational tragedies are preventable through the implementation of sound prevention, reporting and inspection practices, statistics on occupational diseases and injuries among waste collectors and informal waste recyclers are scarce and the occupational hazards facing them has not yet received the attention it deserves in research, public health agendas and at national and county government levels.

The vulnerability of these fragile populations, particularly children, to waste-borne risks and mischief is a growing global problem. A recent study discusses some of the harmful health effects that electronic waste exposure has on children and expectant women (Medina, 2008). Reusing e-waste can result in higher amounts of polychlorinated dibenzo-p-dioxins and dibenzofurans, which may even affect the health of future generations. Children that live in or close to informal reuse zones are exposed to more polycyclic aromatic hydrocarbons than other children, negatively affecting their height and chest circuit. Nitric oxide (NO) and nitrogen dioxide (NO2) concentrations in and around landfills are higher than those permitted by US-EPA and WHO regulations. This translates into health problems for the communities around landfill locations. Research has shown that waste the (Pallow, 2004).

2.6. Theoretical Framework

2.6.1 Sustainable livelihood theory

The system of society governs all human activity, right down to how people make a living. Sustainable livelihood approaches, however, enhance the understanding that the system is likely to distort the regulatory rules for survival, leading subjects to seek out alternate means. Majale (2002) notes that the departments under our form of government don't carry out their mandates for the people. The scavengers do not want to resort to segregating dangerous and non-toxic materials for their survival and welfare at the site. These individuals have families to take care of and feed while sorting solid garbage for valuable resources. They are, nevertheless, unemployed. Thousands of unemployed young people, old people, and women cannot be helped by the government's corrupt deals and lousy policies. Scavenging is the only other means of support for themselves and a method of eradicating poverty.

According to Makaje (2000), occupation refers to the skills, resources (stores, assets, claims, and access), and activities required for a way of life. Work is reasonable if it can adjust to pressure and shocks, recover from them, maintain or improve its capabilities and resources, and provide future-proof job freedoms. Additionally, it ought to benefit several professions both now and in the future, both locally and globally. According to the sustainable livelihood approach, there are adequate resources available to mankind to raise living conditions for both individuals and families. The Dandora dumpsite is a place where low-income people can survive, albeit at their own health risk.

Human ecology, according to Schaefer (2004), is concerned with the interactions between humans and their surroundings. It is obvious that there is a special way in which man makes garbage, which he then uses once more to meet demands, within the system. Scavengers naturally return to waste items as a result when nature forces them to do so in order to survive. Sustainable livelihood approaches advance that a coping and adaptive strategy is sought to respond to external shocks and stresses such as corruption and failing policies when people, households, and communities encounter inefficient regulatory systems. This theory offers a strong conceptual framework for understanding human scavenging as a subsistence tactic in the Dandora dumpsite.

2.6.2 Self-help theory

Individuals care about their own lives, thus inefficient governmental structures and bad policies place a huge burden on them and force them to seek out alternative ways of subsistence. According to this viewpoint, the self-help technique holds that even in challenging circumstances, people will always find a way to survive. Waltz (2004) maintains that no other states can be counted on to contribute to ensuring the state's survival. He also thinks that in a spectrum of many nations vying for sovereignty to manage resources, governments behave rationally. Human scavengers see it as their primary job to seek out a living in opposition to the established social rules of survival.

According to self-help theory, humans have the final say about means of subsistence among several actors in search of resources. Undoubtedly, humans go above and beyond the rules set forth in order to protect life. According to Beebe (1989), no single theory

can adequately describe human behavior, thus self-help approaches aim to offer a deeper understanding and forecast the recurrence of the human scavenging phenomenon as a source of income. Scavenging by humans is an unavoidable behavior. The self-help technique teaches what to expect and the potential outcomes when life's systems are malfunctioning.

2.6.3. Conflict Theory

The theory was recommended by Karl Marx in 2008 and it claims that the society is in a continuous conflict state due to competition for scarce resources. It embraces that the social order is upheld by power and domination, instead of conformity and consensus. In accordance to the conflict theory, the individuals with power and riches attempt to hold on to it through any possible way, primarily by overpowering the powerless and poor. For example, the economically rich and political elites make use of their monetary strength in channeling benefits from both the national government and local government to their well-developed regions. This is what leaves the less privileged persons struggling with various issues, which include SWM. This typically creates helps in creating conflict amid the two groups since the policy as well as legislation that are developed have a tendency of favoring the rich people (Cairns & Sears, 2015). In case of any technological implementation on SWM, the parts which are occupied by the wealthy people are often provided first priority, thus leaving the poverty-affected-people in the shanty town where a lot of the waste is generated suffocating in loads of trash. Most of the employees of NCC provide favored treatment to the areas in which political as well as economic elite live. This theory thus proves that every variables specifically capacity

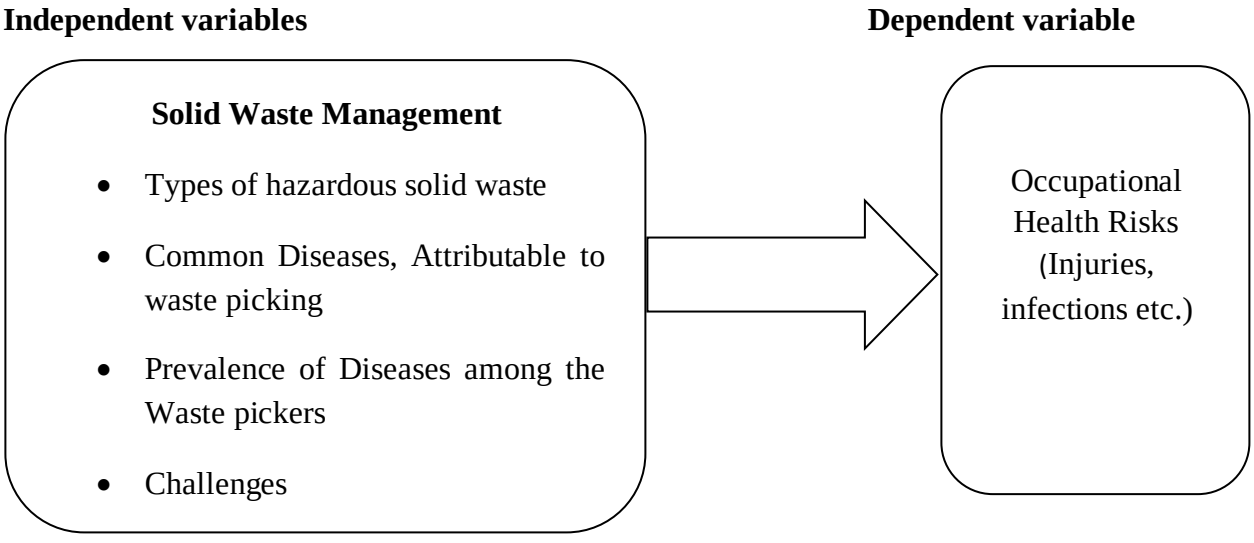
policy as well as legislation, urbanization and technology favors particular class of persons therefore poor waste management in semi structured regions compromise of more than 70% of the population of the population of the city.

2.7. Conceptual Framework

The conceptual framework is a tool that shows the relationship between the independent and dependent variables. The factors that the researcher systematically varies are known as independent variables. The values of dependent variables, on the other hand, are variables that are thought to be dependent on the impacts of the independent variables (Mugenda, 2008). Solid waste management is a component of the independent variable in this instance. The dangers to occupational health are the dependent variable. The conceptual framework below visually depicts the link between these variables.

Figure 2.1:

Conceptual Framework



CHAPTER THREE

METHODOLOGY

3.1. Introduction

This chapter presents the methodology of the study. it presents the research design, target population, sample size and sampling procedure, data collection, pretesting of the research instruments, data collection and data analysis.

3.2. Research Design

The research design used in the study was descriptive. This method of research was chosen because it allowed the analyst to compile data to address inquiries about the context of the study's issue. Engaging analysis establishes and documents the status quo and moreover helps an expert portray a marvel in terms of manner, qualities, and traits (Mugenda & Mugenda, 1999).

As per Orodho (2003), spellbinding overview is a technique for gathering data by meeting or controlling a poll to an example of people. This methodology enabled the gathering of information without controlling the examination factors or the respondents in trying to distinguish/decide the work-related wellbeing issues among solid waste handlers in Nairobi County. Deductions among factors was made without direct intercession from associated varieties of free and ward factors.

3.3. Target Population

The term target population refers to all people or things (the examination unit) that fit the desired criteria. The subject under investigation could be a person, group, country, thing, or anything else about which you want to make logical inferences (Bhattacherjee, 2012). Road sweepers, rubbish pickers, refuse collectors, truck drivers, and their immediate supervisors comprised the study's population in Nairobi.

3.4. Sample and Sampling Technique

The study's sample size and sampling method are described in this section. A sample is a smaller group or sub-bunch drawn from the available population (Mugenda & Mugenda, 1999). Selecting people who are interested in an investigation requires testing. This exchange should be representative of the whole public. Therefore, selecting a subset from a population to participate in the examination is called inspecting (Ogula, 2005). Using the Mugenda and Mugenda's proposed equation, the sample size was calculated (2003). Using the formula suggested by Mugenda and Mugenda, 2003, the sample size for this study was determined:

$$n= (Z\alpha /2)2\ P\ (1-P)\ d2$$

Where; n = the desired sample where population

Z = standard normal deviation (1.96) corresponding to 95% confidence limit.

d = degree of precision usually set at 0.05.

P = Proportion of the target population expected to have the (0.5) P taken as 50%.

$$\mathbf{N}= (1.96)^2\ (0.5)\ (0.5)/0.0025 = 384.16$$

Therefore, the sample size used was 384 respondents.

3.5. Data Collection

Essential information was acquired using a questionnaire. The information was both subjective and quantitative. This research used questionnaires because they are less expense and free from predisposition. The inquiries were both closed and open ended along these lines offering the respondents a chance and an understanding of the exploration targets.

The investigation adjusted a semi-structured questionnaire separated into two areas: segment A for getting information on foundation data of the respondents and, segment B with questions seeking to assess health risks associated with solid waste management among collectors and recyclers. In addition, the researcher also used the interview guide to collect information from the City council official who are the supervisors of the dump site management.

3.6. Pretesting of the Research Instruments

Prior to the fundamental examination, the investigation pre-tried the instrument to upgrade its legitimacy and unwavering quality. A small sample was browsed from the populace. In this exploration, 38 (10% of the sample) respondents were picked to contribute and were not to be members picked for the examination. Ten percent of the sample size of the respondents was adequate for pilot testing (Mugenda & Mugenda 1999). These informed improvements in the questionnaire, the legitimacy and dependability of the instruments where essential remedies of the instrument were made

before the real examination. The pretesting was done in Kangoki dumpsite in Thika, an area far away from Dandora dumpsite to assess the occupational health risk among the solid waste handlers.

3.6.1. Validity

The investigation embraced content legitimacy to demonstrate whether the test things address the substance that the test is intended to quantify. The pilot study supported in deciding precision, clearness and reasonableness of the instruments. It helped to order scant and equivocal things to such an extent that those that don't assess the factors proposed, was adjusted. To guarantee legitimacy, the instruments utilized in the examination were analyzed.

3.6.2. Reliability

Reliability is a proportion of degree to which a specific estimating methodology gives predictable outcomes or information after a rehashed preliminary (Gay 1992). To measure test-retest dependability, the test was managed twice at two divergent focuses on schedule (a distinction of about fourteen days the following test). This sort of dependability accepts that there is no adjustment of the quality or develop being estimated. Cronbach's Coefficient alpha was utilized to figure the connection co-productive to decide how much there was consistency in giving comparative reaction each time the instrument is regulated.

3.7. Data Collection Procedure

To ensure a helpful setting when gathering information, the analyst acquainted himself with the respondents by clarifying the motivation behind the exploration prior to overseeing the instrument (Saunders et al., 2007). A close interaction was set up between the researcher and the respondents to enable factual responses, facilitate continuous communication, and offer clarifications. Each exertion was made to guarantee individual conveyance and organization of the instrument to guarantee a better yield pace of the meeting guides. To gather this information, the analyst directed the interview timetables to the respondents. The essential information was considered productive to the examination since it was solid and precise (Mugenda & Mugenda, 2003).

3.8. Data Analysis

Analyzing data involves looking over the information gathered and drawing conclusions and inferences (Kombo & Tromp, 2006). The information gathered was objectively coded, measured, and dissected. Using the SPSS, quantitative data was examined and presented using percentages, standard deviations, and frequencies. The information was then summarized as tables, diagrams and pie charts. This accommodated a simpler examination and translation of the information inputted. Further the study utilized multiple regressions to find out the relationship between the variables. The model utilized was as below:

$$Y = \alpha + \beta_1 X_1 + e$$

Where

Y=Occupational Health Risk

α = constant term

β_1= Coefficients

X_1= Solid Waste Management

ẹ = Error

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents data analysis and discussions. The study sought to determine the occupational health risks among solid waste handlers in Nairobi County. Primary data was collected through administration of questionnaires and interview guides to the targeted respondents in Dandora dumpsite in Nairobi County.

4.2. Questionnaire Response Rate

Three hundred and eighty-four (384) questionnaires were distributed to the respondents, out of which 300 were completed and returned. This gave a response rate of 78.1%.

4.3. General information

The general information is as shown in table 4.1.

Table 4.1.

General Information

Characteristic		Frequency	Percentage
Gender	Male	237	79%
	Female	63	21%
	Total	**300**	**100**
Age	24 -44	276	92%
	45 years an above	24	8%
	Total	**300**	**100**
Level of education	Primary	114	38%
	Secondary	126	42%
	College	60	20%
	Total	**300**	**100**
Length of time of working in Nairobi County	Less than 1 year	63	21%
	1-5 years	129	43%
	6-10 years	75	25%
	Over 10 years	33	11%
	Total	**300**	**100**

Male respondents made up 79% of the sample, while female respondents made up 21%. This showed that in Nairobi County, men made up the majority of those employed in solid waste management. The majority of responders (92%) were between the ages of 24 and 44, while only 8% were above 45. This showed that the respondents were responsible adults who were familiar with the study's topic and had solid waste management experience.

Of the respondents, 42% had a secondary education, 38% had a primary education, and 20% had a college degree. This showed that the majority of respondents had little education, which may have been sufficient for them to understand problems relating to solid waste management. According to the results, the majority of respondents (43%) said they had worked as trash handlers in Nairobi County for between one and five years, 25% for between six and ten years, 21% for less than a year, and 11% for more than ten years. This showed that the majority of the respondents had handled garbage for a considerable amount of time and were therefore familiar with how the county handled waste, the disposal site, and the associated occupational dangers.

4.3. Types of Waste that are Hazardous to Solid Waste handlers

The first objective of the study was to identify the types of waste that are hazardous to solid waste handlers in Nairobi County. The findings are presented in the following subsections:

4.3.1. Various Wastes that are Hazardous to Solid Waste Handlers

The respondents were requested to describe the various wastes that are hazardous to Solid Waste handlers. According to the respondents the various waste that are hazardous includes human fecal matter, paper sullied with poisons, void compartments with substance buildups like pesticides deposits, solvents just as hints of biomedical wastes like infusions, dirtied swathes and toxic human contaminants (heavy metals) in batteries. The respondents added that hazardous solvents, cements, plating materials, pesticides, asbestos-containing items from development and destruction exercises, cleaning supplies, personal care items, auto supplies, bug sprays, herbicides, and a variety of batteries and sharps, such as broken dishes, were among the waste.

4.3.2. Major Types of Waste Generated in Nairobi County

The respondents were requested to indicate the major types of waste generated in the County. The findings are as shown in Table 4.3.

Table 4.1.

Major Types of Waste Generated in Nairobi County

Type of Solid Waste	Frequency	Percentage
Food Waste	234	78%
Plastic Waste	216	72%
Biomass	180	60%
Paper	168	56%
Metallic Waste	195	65%

From the findings in Table 4.3 78% of the respondents indicated that the major type of waste generated in Nairobi County is food waste, 72% indicated plastic waste, 65%

indicated metallic waste, 60% indicated biomass, while 56% indicated paper waste. This depicts that that the major type of waste generated in Nairobi County is food waste.

4.5. Common Diseases, Attributable to the Dumpsite

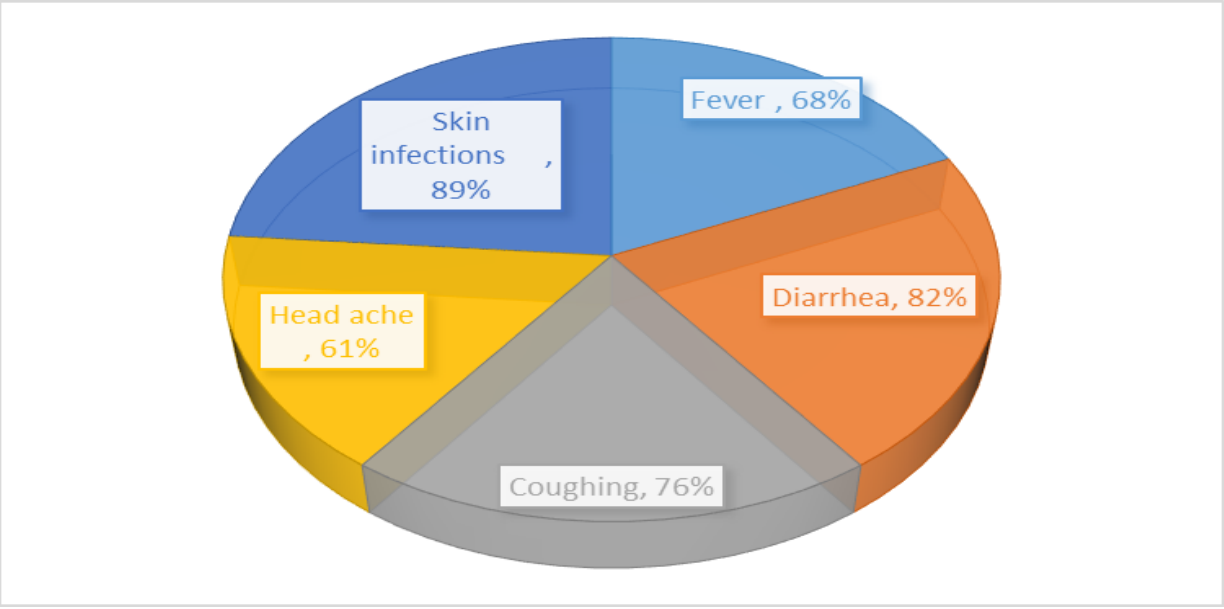
The second objective was to determine the common diseases, among solid waste handlers in Nairobi County. The findings are presented in the following subsections:

4.5.1. Symptoms Attributed to Diseases in Relation to Solid Waste Management

The respondents were requested to indicate the symptoms that are attributed to diseases in relation to solid waste management. The findings are shown in Figure 4.1

Figure 4.1.

Symptoms Attributed to Diseases in Relation to Solid Waste Management



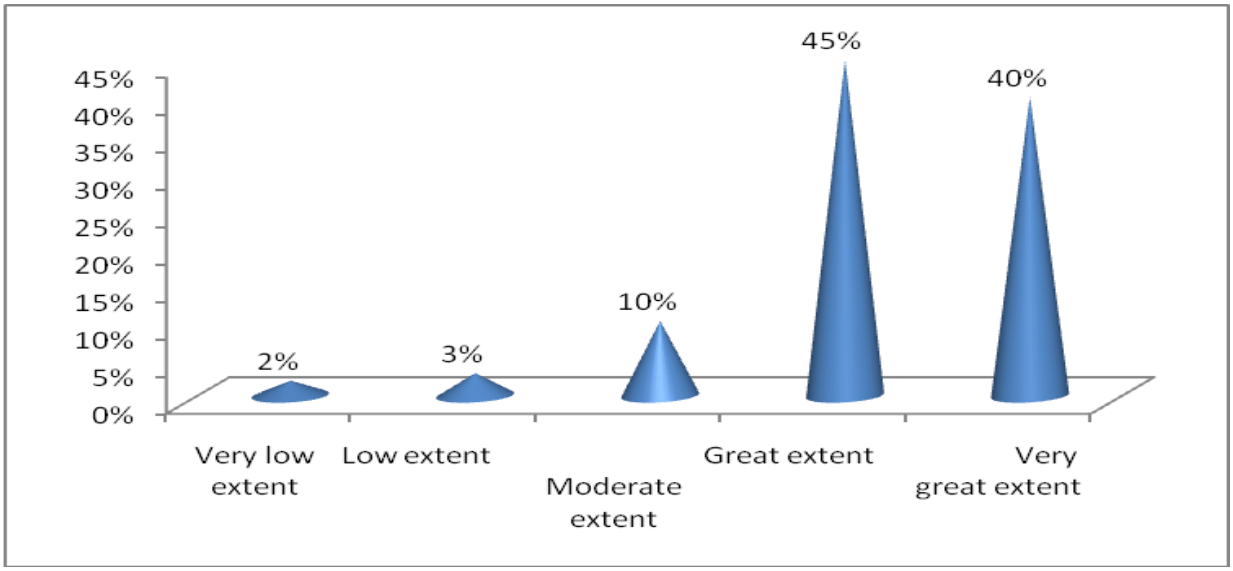
From the findings 89% of the respondents indicated that the symptoms that are attributed to diseases in relation to solid waste management were skin infections, 82% indicated diarrhea, 76% indicated coughing, 68% indicated fever, while 61% indicated headache. This depicts that the symptoms that are attributed to diseases in relation to solid waste management were skin infections.

4.5.2. Extent to Which Symptoms of common diseases attributable to waste management Have Affected Waste Handlers

The respondents were requested to indicate the extent to which the symptoms of diseases in relation to solid waste management have affected them. The findings are shown in Figure 4.2

Figure 4.2.

Extent to Which Symptoms of common diseases attributable to waste management have affected Waste Handlers



From the findings above forty five per cent (45%) of the respondents indicated majorly that the symptoms of diseases in relation to solid waste management have affected them, 40% indicated very great extent, 10% indicated moderate extent, 3% indicated low extent while 2% indicated very low extent. This depicted that majorly the symptoms of diseases in relation to solid waste management have affected solid waste handlers in Dandora dumpsite.

4.5.4. Solid Waste Disposal and Contraction of Related Symptoms and Diseases

The respondents were requested to describe how solid waste disposal sites lead to contraction of related symptoms and diseases. According to the respondents, the gases emitted by the decomposing and burning waste at the dumpsite causes them respiratory complications. Further, the heavy dust blown by traffic at the site equally compromises their health. Respondents were quick to mention the expected effects of exposure to harzardous chemicals from industries, which they scavenge through as they search for materials with some re-sale value form the mountain of wastes.

4.5.5. Suffering from Symptoms Such as Vomiting, Diarrhea, and Flu

The respondents were requested to indicate whether their colleagues who work at the dumpsite suffer from symptoms such as vomiting, diarrhea, and flu.

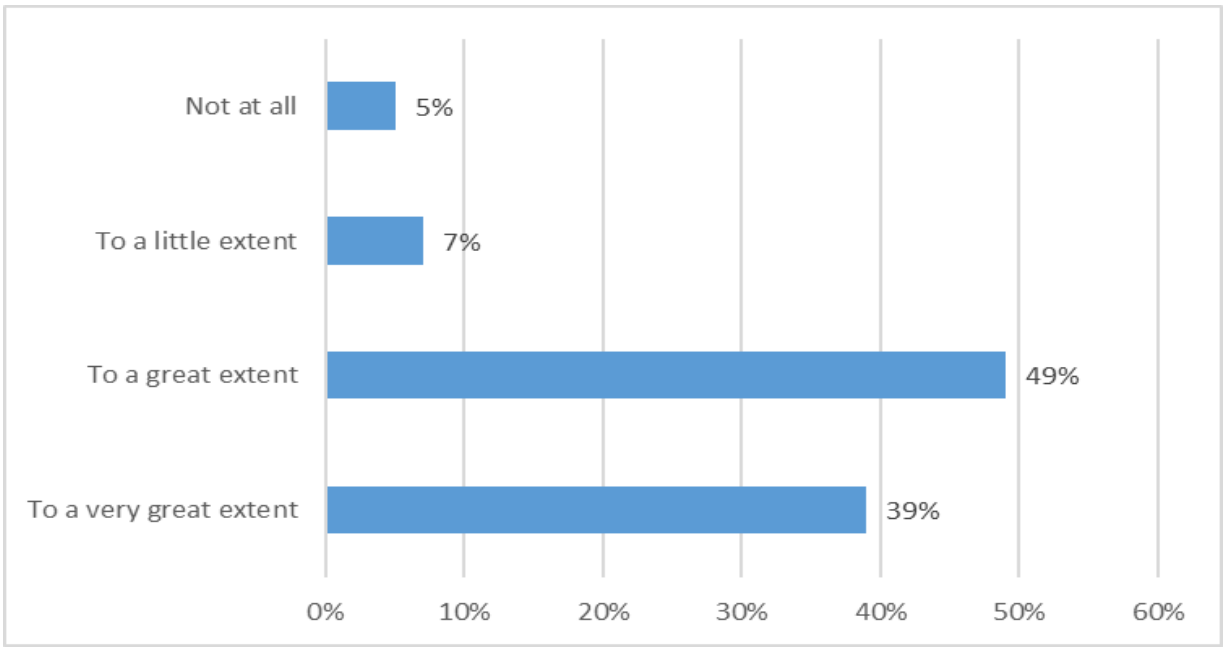
From the findings majority (89%) of the respondents indicated that their colleagues who work at the dumpsite suffer from symptoms such as vomiting, diarrhea, and flu while 11% were of the contrary opinion. This depicted that people who work at the dumpsite mainly suffer from symptoms such as vomiting, diarrhea, and flu.

4.5.6. Prevalence of diseases among work colleagues at the dumpsite

The respondents were requested to rate the prevalence of diseases among work colleagues at the dumpsite. The findings are shown in figure 4.6

Figure 4.2.

Prevalence of Diseases Among Work Colleagues at the Dumpsite



From the findings above most (49%) of the respondents indicated majorly that there is prevalence of diseases among work colleagues at the dumpsite, 39% indicated very great extent, 7% indicated little extent while 2% indicated no extent at all. This depicts that majorly there is prevalence of diseases among work colleagues at the dumpsite.

4.6. Occupational Challenges Experienced by Solid Waste Handlers

The third objective was to find out the occupational challenges experienced by solid waste handlers in Nairobi County. The findings are presented in the following subsections:

4.6.1. Main Challenge as Waste Handler

The respondents were requested to indicate the main challenges they faced as waste handlers. According to the respondents a significant challenge is the lack of participation of squander specialist organisations in management of the dumpsite. A portion of the casual settlements are situated in thickly populated territories with houses cramped up together hindering access with large collection trucks thereby requiring the use of push carts that further leak or litter waste in the settlements during collection and transport to aggregation sites. Majority of the authorized waste administrators and SMEs utilize pushcarts for assortment, as vehicles cannot get to the constricted spaces. The respondents further expressed that public mindfulness and the disposition of individuals towards waste can altogether impact solid waste administration frameworks. The haphazard unloading of squander in different spaces within the County indicated that there is carefree mentality of solid waste management in many zones. This combined with insufficient infra-structure for collection, consolidation, transport and inconsistent or no waste assortment administrations brings about indiscriminate unloading of waste.

4.6.2. Extent of Agreement on Challenges that are Being Faced by Waste Handlers

The respondents were requested to indicate the extent of agreement on challenges that are being faced by waste handlers. The findings are shown in Table 4.4

Table 4.2.

Extent of Agreement on Challenges that are Being Faced by Waste Handlers

Challenges	N	Percentage
The decommission of natural substances produces methane gas which can achieve fire and blasts, and adds to a worldwide temperature alteration and environmental change	300	20
Absence of checking of partners demeanor to garbage removal by solid waste administration specialists	300	18
Insufficient/non-requirement of Environmental laws by Waste administration specialists	300	24
Inhabitants' absence of individual obligation to natural security/wellbeing	300	20
Fierce and scaring mentality of waste administration authorities	300	18

From the findings, 20% of the respondents demonstrated that the decomposition of natural substances creates methane gas which can result in fire and blasts. This adds to a worldwide temperature alteration and environment change. It was followed at 18%by fierce and threatening demeanor of waste administration authorities. The absence of checking of partners disposition to garbage removal by solid waste administration specialists stood at 24% while deficient/non authorization of Environmental laws by Waste administration specialists at 20%. At 18% was occupants' absence of individual obligation to ecological wellbeing/wellbeing. This portrays that the enforcement of environmental laws is seen by waste handlers as a key challenge closely followed by the

inhalation of methane gas resultant from the decomposition of organic matter at the dumpsite. This further has been reported to cause blasts and fires at the dumpsite all which contribute to pollution and sometimes injuries from flying materials after such blasts.

4.6.3. Challenges Faced by the County Government in Waste Management

The respondents were requested to indicate the challenges they think the county government is facing in waste management. According to the respondents the primary difficulties confronting waste administration in the region incorporate deficient financing, helpless foundation and innovation, absence of public mindfulness on great sterile practices, lacking legitimate and administrative systems. Areas are yet to move up to landfills are as yet utilizing unloading destinations for squander the board. The respondents further expressed that the arrangement of solid waste administrations is a costly endeavor, and assets are needed to buy the suitable gear and framework, reserve the support and day-by-day activity of vehicles and hardware and train or upskill staff. The shortage of assets (monetary, specialized and calculated) is a significant impediment to powerful solid waste administration rehearses in the County.

The respondents indicated that absence of advanced technological capacity for separation of waste at the immediate source is considered as one of the main factors that help in hindering effective solid waste management. Waste recycling is costly. Even though current years have had a rise in various waste recycling amenities, the recycling economics is still unfavorable. In several cases, waste recycling is costly when compared

to purchasing the product. Thus, the support of the government in terms of inexpensive land for landfills and grants are usually essential for profitable practicality. There is also underdeveloped market for the products developed through recycling process.

The respondents also indicated that inadequate demand for the recycled goods in the local market is an additional reason that has hindered the development of the waste recycling business. Therefore, there exists some units taking part in recycling waste plastics, paper and paperboard. Unreachability due to the urban and geographical structure, deficiency of appropriately planned collection time schedule and route system, malfunctioning and inadequate operation equipment, open garbage burning, poor final dump site condition and dropping litter at the corner around the waste containers are activities that promote illegal dumping, thus they are the chief technical issue that faces the county.

4.6.4. Coping Measures that are Being Applied by Waste Handlers

The respondents were requested to indicate the coping measures that are being applied by waste handlers to counter the challenges they face. According to the respondents, some of the coping measures include coordinating with residents at estate gatherings including waste administration offices and management of estate associations. This coordination extends to the local area based-organizations, waste broker's associations, retailers and market workers associations and so on to promote segregation of waste and stop indiscriminate garbage disposal. It would also contribute to reduction in unpredictable unloading of waste within undeveloped plots in estates and near the

dumpsite. All this can be accomplished through partners connection, setting up neighborhood anti-litter associations, taking individual proprietorship and obligation of ensuring appropriate waste disposal,. Further actions may include introducing neighborhood Environmental/Sanitation Committees to capture wrongdoers and facilitate safe garbage removal.

4.7. Risks Associated with Solid Waste picking

The fourth objective was to establish the risks associated with solid waste picking among solid waste handlers in Nairobi County. The findings are presented in the following subsections:

4.7.1. Health Risks Associated with Solid Waste Picking at Dandora Dumpsite

The respondents were requested to indicate the health risks associated with solid waste picking at Dandora dumpsite. According to the respondents the solid squanders included, for example, lead based wastes and zinc batteries, other chemical wastes in wrappings or tins and PVC or polythene products. The respondents further expressed that the harmful materials at the site do cause injuries, or damage to waste handlers through infusion, inward breath, or assimilation through the skin. The respondents additionally showed that there were risks of exposure to chemicals emanating from agricultural activities, for instance discarded or expired fungicides, pesticides and rodenticides.

4.7.2. Physical Hazards Suffered by the Waste Pickers

The respondents were requested to indicate the physical hazards suffered by the waste pickers. The findings are shown in Table 4.5.

Table 4.3.

Physical Hazards Suffered by the Waste Pickers

Physical hazards	Frequency	Percentage
Muscular tear	261	87%
Spinal injury	255	85%
Head injury	195	65%
Eye damage	180	60%

From the findings 87% of the respondents indicated that the physical hazards suffered by the waste pickers included muscle tear, 85% indicated spinal injury, 65% indicated head injury, while 60% indicated eye damage. This depicts that the main physical hazard suffered by the waste pickers included muscle tear. This may emanate from the rudimentary tools and vehicles used in collection and transport of waste. The trucks for instance are over three meters high while the garbage buckets weigh over fifty kilograms. It would require huge physical effort to lift the 50kg bin into a truck 4m high and this might lead to the muscle tear reported by most of the respondents.

4.7.3. Exposure of the Waste Pickers to the Health Hazards

The respondents were requested to describe the exposure of the waste pickers to the health hazards. The respondents expressed that the weak populaces who oversee squander, like the waste pickers, are presented to numerous work-related dangers including compound risks, disease, musculoskeletal harm, mechanical injury, enthusiastic weaknesses, and ecological tainting.

4.8. Regression Analysis

To determine the relationship between the predictor variable and occupational health risk, the study used simple regression. After cleaning and coding field data, the study used SPSS version 24 to produce output of the regression statistics. The study's independent variables were solid waste management and the dependent variable was occupational health risk.

4.8.1. Model Summary

The relationship between the predictor variable and occupational health hazards among solid waste handlers in Nairobi County is depicted in the model summary in Table 4.6. The outcomes are shown in Table 4.6.

Table 4.4. ***Model Summary***

Model	R	R Square	Adjusted RSquare	Std. Error of the Estimate	F	P-value
1	0.747	.558	.545	.34309	31.341	.001

a. Predictors: (Constant), solid waste management

b. Dependent Variable: occupational health risks among solid waste handlers in Nairobi County

Based on the data in Table 4.5, the R2 was calculated to be 0.558, which represents a difference of 55.8% in occupational health risks among Nairobi County's solid waste handlers. The independent variable in the model accounts for the difference. Additionally, according to the table, the unexplained discrepancy of 44.2% is due to other elements that are not included in the model. Given the results in the table, it is clear that the model is sound and suitable for use in estimating (sig value is less than 0.05).

4.8.2 ANOVA Results

The findings on the relationship between the predictor variable and occupational health hazards among solid waste handlers in Nairobi County are presented in Table 4.7. The results are displayed in Table 4. 7.

Table 4.5.

ANOVA of the Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.062	1	5.062	42.898	.000[a]
	Residual	35.164	298	.118		
	Total	**40.226**	**299**			

a. Predictors: (Constant), solid waste management

b. Dependent Variable: occupational health risks among solid waste handlers in Nairobi County

Table 4.6's data revealed that the significant value was 0.000, which is much lower than 0.005, indicating that the model was statistically significant. According to this, the model would be used to forecast the associations between Nairobi County's solid waste management, governmental regulations, and occupational health risks among solid waste handlers. Additionally, it was discovered that the model was statistically significant because the F critical (5.062) value was lower than the F estimated (value = 42.898).

4.8.3 Coefficient of Determination

The relationship between the predictor variable and the occupational health risks faced by solid waste handlers in Nairobi County is shown by the coefficient of determination in Table 4.8. The results are displayed in Table 4.8.

Table 4.6. Coefficient of Determination

	Unstandardized Coefficients		**Standardized Coefficients**		
	B	**Std. Error**	**Beta**	**T**	**Sig.**
Model 1(Constant)	0.349	0.573		0.610	0.546
Solid waste management	0.955	0.146	0.747	6.558	0.000

a. **Dependent Variable:** occupational health risks among solid waste handlers in Nairobi County

To ascertain the occupational health risks among solid waste handlers in Nairobi County, a simple regression analysis was carried out. The following equation was produced using SPSS:

$$(\mathbf{Y = \alpha + \beta_1 X_1 + ę})$$

Becomes:

$$(Y= 0.349+ 0.955+ \varepsilon)$$

From the regression taking the independent variable at constant (solid waste management) constant at zero, occupational health risks among solid waste handlers in Nairobi County was 0.349. The data results also showed that a unit increase in solid waste management will result in a 0.955 rise in occupational health risks among solid waste handlers in Nairobi County, holding other independent variables at constant zero. Solid waste management was significant on occupational health risks among solid waste handlers in Nairobi County at a 5% level of significance and a 95% level of confidence.

4.9. Discussion of Findings

4.9.1. Types of Waste that are Hazardous to Solid Waste handlers

The study discovered that among the hazardous trash include human feces, poison-tainted paper, waste containers with pesticide deposits, solvents as well as hints of medical waste such infusions, soiled gauzes, and heavy metals in batteries. Adeniran et al. (2017) defined solid waste as the range of trash and rubbish that arise from the activities of human beings and animals, which are thrown away as undesirable and

unusable. Solid waste is mainly produced from residential, commercial and industrial activities in a particular region, and might be controlled in various means. Thus, landfills are characteristically categorized as municipal, sanitary, construction and industrial or demolition waste sites. Solid waste can be characterized centered on material, like plastic, glass, paper, organic and metal waste. Classification might similarly be centered on hazard potential, which include radioactive, flammable, toxic, non-toxic or infectious waste. Classifications may perhaps relate to the waste origin, like industrial, commercial, domestic, demolition and institutional or construction.

The study also discovered that the waste included hazardous solvents, cements, plating materials, pesticides, asbestos-containing items from construction and destruction projects, cleaning supplies, personal care items, automobile supplies, insecticides, and herbicides, as well as variety that combines batteries and sharps like broken crystal. According to the survey, food waste is the main type of waste produced in Nairobi County. According to Cointreau (2006), the organization of waste, the concept of waste and its biodegradability, the strategies for treating waste, the waste preparation methods used, and their removal are what determine the health risks that are unavoidable for either the laborer or the residents nearby waste offices. Although non-industrialized countries have relatively low levels of economic activity, this does not mean that their solid waste does not contain hazardous wastes that pose real health risks to the general public, according to solid waste experts. According to ARIJ (2009), waste that is produced on the streets build unfriendly smells and is mainly form the breeding sites for insects and vermin that results to diseases; hazardous resources from aimlessly and

erroneously discarded waste can leak into and contaminate resources of water, which include groundwater or any main drinking water source. Thus, polluted earth as well as water get into the body of human beings, through drinking water, animal products and vegetables, whereas burning the solid left-overs contaminates the air, leading to severe health issues, which include respiratory diseases, cancer, and other diseases. Irrespective of the starting point, hazard or content potential, every solid waste needs to be systematically controlled to guarantee ecological best practices. Since solid waste management is a life-threatening feature of environmental sanitation, it must be assimilated into the environmental planning agenda.

4.9.2. Common Diseases, Attributable to the Dumpsite

The study found that the symptoms that are attributed to diseases in relation to solid waste management were skin infections. The study also discovered that solid waste management has significantly impacted them in terms of disease symptoms. The study discovered that because inorganic arsenic has disease-causing qualities, it is linked to illnesses like lung, kidney, bladder, and skin disorders when it is gathered from industrial processes or burned vegetation at a dumpsite. According to Loboka et al. (2013), the effects of ineffective garbage assortment and hopeless waste management are incalculable. Genuine health-related problems for people and the environment are caused by a lack of variety and ineffectual eradication practices.

Cadmium is frequently found in discarded wastes such polyvinyl chloride, cleanser containers, and zinc batteries. In the human body, this heavy metal bio-aggregates,

affecting internal organs like the liver, kidneys, lungs, bones (causing osteoporosis), the mind, as well as the primary sensory system. According to the study, coworkers who work at the dumpsite have flu-like symptoms as well as symptoms like nausea and diarrhea. The survey also discovered that illnesses are primarily prevalent among coworkers at the dumpsite. According to Aibor et al. (2016), solid waste pollution contributes to the spread of infectious diseases such tuberculosis, hepatitis B and C, yellow fever, West Nile fever, dengue fever, and hemorrhagic fever. The practice of "water body-unloading" is bad news for the population's health and the economy.

4.9.3. Occupational Challenges Experienced by Solid Waste Handlers

A portion of the unplanned settlements in the county are situated in thickly populated zones where shelters are closely packed leaving only narrow pathways for pedestrians. There, the greater part of the authorized waste administrators and SMEs utilize pushcarts for assortment, as vehicles can't get to the spaces. The respondents also stated that public awareness and people's attitudes regarding garbage can have a significant impact on solid waste administration frameworks. There is a casual attitude toward trash handling in numerous localities, as evidenced by the amount of litter and erratic offloading in several County locations. The research also discovered that methane gas was formed during the breakdown of natural or organic materials, which is known to contribute to environmental change and may have caused the fires and explosions at the dumpsite. According to Cointreau (2008), low-income residents of areas tend to either dispose of their garbage in the closest open space, brook, or river, or simply consume it on their patios. Uncollected trash can accumulate in the streets and tunnels, which could lead to

flooding. Additionally, waste can be transported by run-off water to lakes, oceans, and streams, which can harm aquatic biological systems (Bullard, 2011).

The examination tracked down that the primary difficulties confronting waste administration in the region incorporate deficient financing, helpless foundation and innovation, absence of public mindfulness on safe waste management practices, insufficient lawful and administrative structures. Many areas are yet to utilize designated dumpsites and waste is unloaded indiscriminately. The respondents further expressed that the organization of solid waste administrations is a costly endeavor and many residents are unwilling to contribute or pay, and assets are needed to buy the proper hardware and tools, support day by day operation of garbage vehicles and train or upskill waste management work force. The shortage of assets (monetary, specialized equipment) is a significant block to viable solid waste administration initiatives in the County. According to Muniafu and Otiato's (2010) study, which was based on a quantitative analysis of data, improper segregation practices expose waste handlers to serious health risks in addition to widening the range of people who are vulnerable to those risks, including doctors, nurses, patients, hospital management staff, the general public, and the environment. Hospital trash is improperly disposed of as a result of improper waste segregation, a failure to obey municipal and system rules, as well as a disregard for WHO waste management principles. Muniafu and Otiato (2010) assert that this is a direct outcome of challenges with ignorance, slack law enforcement, a lack of process ownership, and holes in continual monitoring of waste management practices.

The study found that absence of advanced technological capacity for separation of waste at the immediate source is considered as one of the main factors that help in hindering effective solid waste management. Waste recycling is costly. Even though current years have had a rise in various waste recycling amenities, the recycling economics is still unfavorable. In several cases, waste recycling is costly when compared to purchasing the product. Thus, the support of the government in terms of inexpensive land for landfills and grants are usually essential for profitable practicality. There is also underdeveloped market for the products developed through recycling process.

The study found that inadequate demand for the recycled goods in the local market is an additional reason that has hindered the development of the waste recycling business. Therefore, there exists some units taking part in recycling waste plastics, paper and paperboard. Unreachability due to the urban and geographical structure, deficiency of appropriately planned collection time schedule and route system, malfunctioning and inadequate operation equipment, open garbage burning, poor final dump site condition and dropping litter at the corner around the waste containers are activities that promote illegal dumping, thus they are the chief technical issue that faces many cities. According to Egondi et al. (2015), there is insufficient training given to protect waste handlers, a lack of monitoring and control mechanisms, a lack of personnel protective equipment during the segregation and transportation of biomedical waste, careless dumping of clinical waste within the noninfectious waste, and exposing workers to the risk of waste hazards. From a management perspective, Allison and Von Blottnitz (2010) noted that waste segregation reduces risks to handlers while simultaneously lowering the cost of

disposal because some non-hazardous wastes can be recycled or reused, which lowers expenses.

In accordance with a regulatory requirement for waste management compliance, Ahmed et al. (2015) found that 90% of Nairobi County biomedical waste handlers had subpar audit reports with records of work-related incidents. Ahmed et al. (2015) evaluated the record-keeping compliance of 30 firms out of 100 that produce biological waste and found that 73% did not preserve records to avoid accountability for workers who were at risk of accidents and other working risks. The study discovered that the primary causes of infection for illnesses like hepatitis B and HIV were liquid wastes, plastics, incinerator ash, and injuries from sharp objects like needles and blades. The lack of knowledge on how to apply preventive measures to human health and contamination from untreated anatomical waste, for example, are some of the new difficulties facing workplace accidents and workplace accidents (Parizeau, 2015).

4.9.4. Risks Associated with Solid Waste picking

According to the study, human pollutants with toxicological characteristics can be found in solid waste produced by businesses and industries, including lead and zinc batteries, cleaner compartments, and PVC. For instance, cadmium aggregates in the body of a person can affect how certain organs, including the liver, kidneys, lungs, bones, placenta, brain, and focal sensory system, work. The investigation tracked down that the actual risks endured by the waste pickers included muscle tear. The examination likewise tracked down that the people who make use of squander at the dumpsite do it as

a source of livelihood and are presented with numerous work-related dangers including risks to diseases, musculoskeletal harm, mechanical injury and are looked down upon.

CHAPTER FIVE
SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter presents summary, conclusions and recommendations on the occupational health risks among solid waste handlers in Nairobi County.

5.2. Summary

5.2.1. Types of Waste that are Hazardous to Solid Waste handlers

The study's first objective was to identify the waste categories that pose risks to Nairobi County's solid waste handlers. According to the report, hazardous waste includes things like human feces, poison-tainted paper, empty containers with pesticide buildups, solvents only as clues of clinical wastes like infusions, destroyed tissues, and heavy metals in batteries. The investigation also discovered that the waste contained hazardous solvents, glues, plating materials, and pesticides from commercial sources, as well as hazardous asbestos items from construction and demolition projects, cleaning supplies, personal care products, automobile accessories, bug sprays, herbicides, and a variety that includes batteries and sharps like broken dishware. According to the survey, food waste is the main type of waste produced in Nairobi County.

5.2.2. Common Diseases, Attributable to the Dumpsite

The second objective was to determine the common diseases, among solid waste handlers in Nairobi County. The study found that the symptoms that are attributed to

diseases in relation to solid waste management were skin infections. The study also found that majorly the symptoms of diseases attributed to solid waste management have affected most of the respondents.

5.2.3. Occupational Challenges Experienced by Solid Waste Handlers

The third objective was to find out the occupational challenges experienced by solid waste handlers in Nairobi County. The study found that access was a key challenge for specialized waste management as most settlements have access obstructed by uncontrolled developments. A portion of the unplanned settlements in the county are situated in thickly populated zones where shelters are closely packed leaving only narrow pathways for pedestrians. Around there, a large portion of the authorized waste administrators and SMEs utilize wheel barrows for assortment as vehicles cannot get to the spaces. The respondents further expressed that public mindfulness and the disposition of individuals towards waste can fundamentally impact solid waste administration frameworks. The measure of litter and unpredictable unloading in different spaces of the County recommend that there is a careless waste disposal in many areas. The examination likewise tracked down that the disintegration of natural substances, which produces methane gas which can result in fire and blasts and adds to global temperature boost and environmental change.

The examination tracked down that the principal challenges confronting waste administration in the region incorporate deficient financing, helpless foundation and innovation, absence of public mindfulness on management practices, insufficient lawful

and administrative systems. The county is yet to upgrade waste management to landfills are yet utilizing dumpsites. The respondents further expressed that huge finances are needed to buy the suitable hardware and tools, ensure daily operation of vehicles and all necessary safety gear for workers and worker skills training. The shortage of assets (monetary, specialized equipment) is a significant obstacle to viable solid waste administration in the County.

The study found that absence of advanced technological capacity for separation of waste at the immediate source is considered as one of the main factors that help in hindering effective solid waste management. Waste recycling is costly. Even though current years have had a rise in various waste recycling amenities, the recycling economics is still unfavorable. In several cases, waste recycling is costly when compared to purchasing the product. Thus, the support of the government in terms of inexpensive land for landfills and grants are usually essential for profitable practicality. There is also underdeveloped market for the products developed through recycling process.

The study found that inadequate demand for the recycled goods in the local market is an additional reason that has hindered the development of the waste recycling business. Therefore, there exists some units taking part in recycling waste plastics, paper and paperboard. Unreachability due to the urban and geographical structure, deficiency of appropriately planned collection time schedule and route system, malfunctioning and inadequate operation equipment, open garbage burning, poor final dump site condition

and dropping litter at the corner around the waste containers are activities that promote illegal dumping, thus they are the chief technical issue that faces many cities.

The study found that some of the coping measures include coordinating with residents at estate gatherings including waste administration offices and management of estate associations. This coordination extends to the local area based-organizations, waste broker's associations, retailers and market workers associations and so on to promote segregation of waste and stop indiscriminate garbage disposal. It would also contribute to reduction in unpredictable unloading of waste within undeveloped plots in estates and near the dumpsite. All this can be accomplished through partners connection, setting up neighborhood anti-litter associations, taking individual proprietorship and obligation of ensuring appropriate waste disposal. Further actions may include introducing neighborhood Environmental/Sanitation Committees to capture wrongdoers and facilitate safe garbage removal.

5.2.4. Risks Associated with Solid Waste picking

The fourth objective was to establish the risks associated with solid waste picking among solid waste handlers in Nairobi County. The study discovered that cadmium, which acquires its toxicological qualities from its chemical similarity to zinc, is present in the solid wastes created in organizations, such as lead and zinc batteries, cleanser compartments, and PVC. The accumulation of cadmium in the human body affects a number of organs, including the liver, kidneys, lungs, bones, placenta, brain, and central nervous system. The investigation tracked down that the actual dangers endured by the

waste pickers included muscle tear. The examination likewise tracked down that the weak populaces who oversee squander, like the waste pickers, are presented to numerous work-related dangers including compound risks, disease, musculoskeletal harm, mechanical injury, passionate weaknesses, and ecological defilement.

5.3. Conclusion of the Study

The study came to the conclusion that human feces, poison-tainted paper, pesticide-coated waste holders, solvents only as hints of clinical wastes like infusions, dirty gauzes, and human contaminants in batteries are among the hazardous wastes. The manifestations that were linked to waste handlers' occupational health were skin diseases. The examination additionally found that generally those symptoms of diseases associated with waste management affected the respondents.

The study concluded that the primary difficulties confronting waste administration in the county incorporate deficient financing, absence of public awareness on waste management practices, non-implementation of environmental management laws. The county is yet to move up to landfills are yet utilizing dumpsites for squander management where final safe management of waste is lacking.

The study concluded that absence of advanced technological capacity for separation of waste at the immediate source is considered as one of the main factors that help in hindering effective solid waste management. Waste recycling is costly. Even though current years have had a rise in various waste recycling amenities, the recycling economics is still unfavorable. In several cases, waste recycling is costly when compared

to purchasing the product. Thus, the support of the government in terms of inexpensive land for landfills and grants are usually essential for profitable practicality. There is also underdeveloped market for the products developed through recycling process.

The study concluded that inadequate demand for the recycled goods in the local market is an additional reason that has hindered the development of the waste recycling business. Therefore, there exists some units taking part in recycling waste plastics, paper and paperboard. Unreachability due to the urban and geographical structure, deficiency of appropriately planned collection time schedule and route system, malfunctioning and inadequate operation equipment, open garbage burning, poor final dump site condition and dropping litter at the corner around the waste containers are activities that promote illegal dumping, thus they are the chief technical issue that faces the county.

Establishment of Neighborhood Environmental/Sanitation Committees would go a long way in improving waste management at the grassroots.

5.4. Recommendations of the Study

Based on the study finding the following recommendations are made:

1. There is need for the county government to re-think solid waste management to support Nairobi City County inhabitants to separate waste at source, reuse what can be reused and afterward delivery to the waste pickers that which they cannot reuse.

2. The government should likewise support settlement level solid waste management associations to oversee waste removal strategies from the estates and follow up on final disposal at designated points to eliminate unloading of garbage in the Nairobi river.

3. There is need for the county government to put resources into innovation for energy recovery from the waste instead of open burning at the Dandora dumpsite.

4. The county government should take measures for advancement of a framework for removal of the garbage from the Nairobi river and alleys.

5. There is need for the county government to link solid waste organizations with the private sector and think of strategies to support reusing and advancement of utilization of completed reused items by local people and industries.

6. The health effects linked to improper waste disposal are many especially for the population living close to illegal dumpsites. The study established that one of the greatest challenges of SWM in Nairobi county is illegal dumping sites. The study therefore recommends that the county government comes up with a policy to eliminate indiscriminate dumping of waste and develop technological measures of profitably managing solid waste in Nairobi county.

7. The study recommends that awareness campaign of 4R's as a method of solid waste management should be promoted in Nairobi county. The waste

management department within the county should conduct workshops for the unskilled workers all along the waste management stream to ensure they protect themselves from occupational hazards and apply safe waste management practices for the benefit of the environment and their very own wellbeing.

5.6. Areas for Further Study

The main focus of the study was to establish the occupational health risks among solid waste handlers in Nairobi County. This forms the ground work for more researches to be conducted on the same subject for more information to be generated. The area of study was in Nairobi County and thus the study had a limited scope. Further research is recommended to establish the occupational health risks among solid waste handlers at other levels in the waste stream. The research did not use longitudinal data to establish incident counts on diseases arising from solid waste, future research can be done using the data to establish and analyze the quantitate aspects of the named phenomena and link this to the diseases most reported at the medical facilities near the dumpsites. Further research needs to be done to investigate the possible solutions to the challenges faced. In addition, a research study can be formulated to carry out the challenges facing waste management in Kenya.

REFERENCES

Abbà, A., Collivignarelli, M. C., Sorlini, S., & Bruggi, M. (2014). On the reliability of reusing bottom ash from municipal solid waste incineration as aggregate in concrete. *Composites Part B: Engineering*, *58*, 502-509. https://doi.org/10.1016/j.compositesb.2014.11.008

Abhay, K. R. (2010). Problems of Municipal Solid Waste Management in Urban Areas. *Solid Waste Management: Present and Future Challenges*. https://doi.org/10.1155/2010/8391616

Abul, S. (2010). Environmental and health impact of solid waste disposal at Mangwaneni dumpsite in Manzini: Swaziland. *Journal of Sustainable development in Africa*, *12*(7), 64-78. DOI:10.4236/jep.2010.47076

Achankeng, E. (2003). Globalization, urbanization and municipal solid waste management in Africa. In *Proceedings of the African Studies Association of Australasia and the Pacific 26th annual conference* (pp. 1-22). DOI: 10.19080/IJESNR.2003.21.556057

Adeniran, A. E., Nubi, A. T., & Adelopo, A. O. (2017). Solid waste generation and characterization in the University of Lagos for a sustainable waste management. *Waste management*, *67*, 3-10. https://doi.org/10.1016/j.wasman.2017.05.002

Ahmed, H. & Khan, B. A., Cheng, L., Khan, A. A., (2015). Healthcare waste management in Asian developing countries: A mini review. *Waste management & research*, *37*(9), 863-875. https://doi.org/10.1177/0734242X19857470

Aibor, T. H., Obiajunwa, P. O., Obiajunwa, C. J., Obisanya, O. A., Odanye, O. H., & Odeleye, A. O. (2016). Solid waste management and health hazards associated with residence around open dumpsites in heterogeneous urban settlements in Southwest Nigeria. *International Journal of Environmental Health Research, 32*(6), 1313-1328. https://doi.org/10.1080/09603123.2021.1879738

Ajani, O. I. Y. (2008). *Determinants of an effective solid waste management in Ibadan Metropolis, Oyo state, Nigeria*. https://doi.org/10.1016/j.wasman.2008.09.005

Allison, K., & Von Blottnitz, H. (2010). *Solid waste management in Nairobi, a situational analysis, technical document accompanying the integrated solid waste management plan*. *UNEP*

Alston, R. (2013). Application of life cycle assessment on electronic waste management: a review. *Environmental management*, *59*(4), 693-707. https://doi.org/10.1016/j.jclepro.2013.07.009

African Population and Health Research Center-APHRC (2017). An assessment of the evolution of Kenya's solid waste management policies and their implementation in Nairobi and Mombasa: analysis of policies and practices. *Environment and Urbanization*, *29*(2), 515-532. https://doi.org/10.1177/0956247817700294

Arab Reporters for Investigative Journalism-ARIJ (2009). *Evaluation of solid waste management in Northern West Bank, Palestine*. http://hdl.handle.net/20.500.11889/5586

Austin, T. & Schill, M. (2011). Sustainable social work: An environmental justice framework for social work education. *Social Work Education, 34*(5), 513-527. https://doi.org/10.1080/02615479.2015.1063601

Beasley, R. (2010). The impact of an efficient collection sites location on the zoning phase in municipal solid waste management. *Waste management*, *34*(11), 1949-1956. https://doi.org/10.1016/j.wasman.2014.05.026

Beebe, B., (1989). A dyadic systems view of communication. In *Relational perspectives in psychoanalysis* (pp. 61-81). Routledge. https://doi.org/10.1016/j.wasman.2014.02.003

Bhattacherjee, A. (2012). *Social science research: Principles, methods, and practices.* http://scholarcommons.usf.edu/oa_textbooks

Boadi, M. & Markku, W. (2015). Solid waste management and its health implications on the dwellers of Kumasi metropolis, Ghana. *Current Research Journal of Social Sciences, 7*(3), 81-93. https://doi.org/10.1016/j.cogsc.2015.04.017

Bryant, W. (2011). Is the concept of a green economy a useful way of framing policy discussions and policymaking to promote sustainable development? *Natural*

Resources Forum 35 (1), 63-72. Oxford, UK: Blackwell Publishing Ltd. DOI: 10.1111/j.1477-8947.2011.01347.x

Bullard, R. D. (2011). *Sacrifice zones: the front lines of toxic chemical exposure in the United States*. https://doi.org/10.1289/ehp.119-a266

Charzan, R, (2012). Environmental Impacts of Solid Waste Containing Metals. *Biotechnology for Treatment of Residual Wastes Containing Metals*. DOI: 10.4103/2277-9183.122430

Cointreau, S. (2006). *Occupational and environmental health issues of solid waste management: special emphasis on middle-and lower-income countries*. Urban papers, 2. https://doi.org/10.1016/j.wasman.2016.12.028

Domfeh, M. K., (2012). Partial Replacement of Cement with Glass Bottle Waste Powder in Concrete for Sustainable Waste Management: A Case Study of Kumasi Metropolitan Assembly, Ashanti Region, Ghana. *Journal of Civil Engineering Research, 10*(2), 29-38. DOI: 10.5923/j.jce.20201002.01

Egondi, T., Muindi, K., Kyobutungi, C., Gatari, M., & Rocklöv, J. (2015). Measuring exposure levels of inhalable airborne particles (PM2. 5) in two socially deprived areas of Nairobi, Kenya. *Environmental research, 148*, 500-506. https://doi.org/10.1016/j.envres.2016.03.018

Gakungu, N. K., (2011). Solid waste management in Kenya: A case study of public technical training institutions. *ICASTOR Journal of Engineering*, *5*(3), 127-138. https://doi.org/10.1016/j.wasman.2010.03.007

Garg, V. K., & Sarkar, B. K. (2013). A study waste management status in health farcicalities of an urban area. *International Journal of Pharma and Bio Sciences 4*, 1107-12. https://globalpresshub.com/index.php/ABAARJ/article/view/993

Gay, S. W., (1992). *Air quality and emissions from livestock and poultry production/waste management systems*. https://doi.org/10.3155/1047-3289.58.6.806

Girling, A. (2015). Residents' perceptions and attitudes towards urban solid waste management in the Berekum Municipality, Ghana. *Oguaa Journal of Social Sciences*, *7*(2), 25-37. http://hdl.handle.net/123456789/2688

Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste management*, *33*(1), 220-232. https://doi.org/10.1016/j.wasman.2012.09.008

Hoornweg, D., & Bhada-Tata, P. (2012). What a waste: a global review of solid waste management. http://hdl.handle.net/10986/17388

Jerie, S. (2016). Occupational risks associated with solid waste management in the informal sector of Gweru, Zimbabwe. *Journal of Environmental and Public Health*, *2016*. https://doi.org/10.1155/2016/9024160

Joseph, D., Megan, K.J., James, L., Eliana, V. G., Morton, B., Shannon, L. B., Elizabeth, G. J., Lauren, H., & Rohit, J. (2016). Characterization of municipal solid waste collection operations. *Resources, Conservation and Recycling*, *114*(3),92-102. DOI: 10.1016/j.resconrec.2016.07.012

Karanja, A., & Okoth, R. (2003). *The Role of Public Private Partnerships in Enhancing Local Government Service Delivery: The Case of Solid Waste Management (SWM) In Nairobi Kenya.* Policy Briefs on Governance Issues: Special Issue, (7A). https://doi.org/10.1177/0956247817700294

Kenya National Bureau of Statistics-KNBS, (2010). Partnerships for sustainable cities as options for improving solid waste management in Nairobi city. *Waste Management & Research*, *39*(1), 25-31. https://doi.org/10.1177/0734242X209677

Kukreja, L. M., Dayal, R. K., Samajdar, I., Mulki, S. V., Ganesh, P., Parvathavarthini, N., & Kaul, R. (2009). A novel pre-weld laser surface treatment for enhanced inter-granular corrosion resistance of austenitic stainless steel weldment. *Welding Journal 88*(12) 233s-242s. https://doi.org/10.1177/0734242X18819752

Loboka, M. K., Shihua, Q., Celestino, J. L., Hassan, S. O., & Wani, S. (2013). Municipal solid waste management practices and fecal coliform water contamination in the cities of the developing countries: The case of Juba, South Sudan. *International Journal of Environmental Sciences*, *3*(5), 1614. DOI: 10.6088/ijes.2013030500031

Makaje, N. (2000). Occupational Health Risk of Waste Pickers: A Case Study of Northern Region of South Africa. *Journal of environmental and public health*, 5 (34), 2000 https://doi.org/10.1155/2021/5530064

Medina, M. (2008). The informal recycling sector in developing countries: organizing waste pickers to enhance their impact. *5*(25), 20-86. http://hdl.handle.net/10986/10586

Medina, S. (2013). Valorisation of the organic fraction of municipal solid waste. *Waste Management & Research*, *37*(1), 59-73. https://doi.org/10.1177/0734242X18812651

Mugenda, O. M., & Mugenda, A. G. (1999). *Research methods: Quantitative and qualitative approaches*. Acts press

Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: Quantitative and. Qualitative. Approaches.* African Centre for Technology Studies.

Mugenda, A. G., & Mugenda, A. G. (2008). *Social science research: Theory and principles.* ACTS

Muniafu, M., & Otiato, E. (2010). Solid Waste Management in Nairobi, Kenya. A case for emerging economies. *Journal of Language, Technology & Entrepreneurship in Africa*, *2*(1), 342-350. DOI: 10.4314/jolte. v2i1.52009

Mwenda, T. Ingham, M. & Ominde, N. (2018). *Solid Waste Management and Health Effects in Nairobi County, Kenya* [Doctoral dissertation, University of Nairobi]. http://hdl.handle.net/11295/105415

Nairobi Population, (2017). *Urolithiasis analysis in a multiethnic population at a tertiary hospital in Nairobi, Kenya. BMC research notes, 10(1), 1-5*. http://hdl.handle.net/11295/105415

Ngau, P., & Kahiu, N. (2009). *ISWM secondary data report on solid waste inventory in Nairobi: report of the National Technical Taskforce on preparation of an integrated solid waste management plan for Nairobi*. http://www.iajournals.org/articles/iajsse_v2_i1_158_167.pdf

Ngoc, U. N., & Schnitzer, H. (2009). Sustainable solutions for solid waste management in Southeast Asian countries. *Waste management*, *29*(6), 1982-1995. https://doi.org/10.1016/j.wasman.2008.08.031

Ogula, L. (2005). *Factors Influencing Waste Management in Public Hospitals in Nakuru County, Kenya* [Doctoral dissertation, University of Nairobi]. http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/55747

Onibokun, T. (2009). Evaluation of solid waste generation, categories and disposal options in developing countries: a case study of Nigeria. *Journal of Applied*

Sciences and Environmental Management, *13*(3) 35-98. DOI: 10.4314/jasem.v13i3.55370

Organization for Economic Cooperation and Development , (2012). The impact of an efficient collection sites location on the zoning phase in municipal solid waste management. *Waste management*, *34*(11), 1949-1956. https://doi.org/10.1016/j.wasman.2014.05.026

Orodho, A. J. (2003). Essentials of educational and social science research methods. *Nairobi: masola publishers*, *54*, 71-82.

Pacione, F. (2015). Inclusive municipal solid waste management policy in Nigeria: engaging the informal economy in post-2015 development agenda. *Local environment*, *22*(2), 203-224. https://doi.org/10.1080/13549839.2016.1188062

Parizeau, K., (2015). Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. *Waste management*, *35*, 207-217. https://doi.org/10.1016/j.wasman.2014.09.019

Patan, S., & Mathur, P. (2015). Assessment of biomedical waste management in government hospital of Ajmer city-a study. *International Journal of Research in Pharmacy & Science*, *5*(1) 300-453. DOI: www.ijrpsonline.com

Pellow, D. N. (2004). The politics of illegal dumping: An environmental justice framework. *Qualitative sociology*, *27*(4), 511-525. https://doi.org/10.1016/j.wasman.2015.04.033

Purvis, S. (2015). Epiphytic lichens as indicators of environmental quality around a municipal solid waste landfill (C Italy). *Waste Management*, *42*, 67-73. https://doi.org/10.1016/j.envpol.2006.03.042

Reddy, P. J. (2011). Municipal solid waste management. *The Netherlands: CRC Press/Balkema*. https://doi.org/10.1016/j.wasman.2008.07.016

Regassa, N., Sundaraa, R. D., & Seboka, B. B. (2011). Challenges and opportunities in municipal solid waste management: The case of Addis Ababa city, central Ethiopia. *Journal of human ecology*, *33*(3), 179-190. https://doi.org/10.1080/09709274.2011.11906358

Rotich, B. R. (2015). An Assessment of How Various Types of Solid Wastes Affect Their Management in Laini Saba Location, Kibra Sub-County, Nairobi County, Kenya. 4 (2), 1-5, Available at: www.paperpublications.org

Rushton, L. (2003). Health hazards and waste management. *British medical bulletin*, *68*(1), 183-197. https://doi.org/10.1093/bmb/ldg034

Saunders, M., Lewis, P. & Thornhill, A. (2007). *Research methods. Business Students* (4th Ed) Pearson Education Limited,

Schafer, M. L., (2004). Assessment of the total content and leaching behavior of blends of incinerator bottom ash and natural aggregates in view of their utilization as road base construction material. *Waste management*, *98*, 92-101. https://doi.org/10.1016/j.wasman.2019.08.012

Schübeler, A. (2010). Municipal solid waste management in developing countries: Future challenges and possible opportunities. *Integrated waste management*, *2*, 35-48. http://hdl.handle.net/20.500.11889/2433

Sharholy, M., Ahmad, K., Mahmood, G., & Trivedi, R. C. (2008). Municipal solid waste management in Indian cities–A review. *Waste management*, *28*(2), 459-467. https://doi.org/10.1016/j.wasman.2007.02.008

Siddharudha, S. and & Sowmyashree, H. (2015). Occupational exposure to infection: a study on healthcare waste handlers of a tertiary care hospital in South India. *The Journal of the Association of Physicians of India*, *63*(11), 24-7. DOI: 10.9734/AJEE/2019/v9i230088

Bammeke, A. O., & Omishakin, M. A. (1985). A study on the characteristics of refuse in Ibadan, Nigeria. *Waste management & research*, *3*(3), 191-201. https://doi.org/10.1016/0734-242X(85)90110-7

Stren, M. & White, W. (2012). *Solid waste management: Principles and practice*. Springer Science & Business Media.

Tchobanoglous, J. (2003). Municipal solid waste management in Asia: A comparative analysis. In *Workshop on sustainable landfill management* (Vol. 35, pp. 3-15). https://doi.org/10.1021/es025774p

United Nations Environment Programme, (2005). Development of waste management practices in Indonesia. *European journal of scientific research*, *40*(2), 199-210. doi: http://www.eurojournals.com/ejsr.htm

United Nations Environment Programme/ National Environment Management Authority (2003). Strategy Implementation Practices on Performance of Solid Waste Disposal Management in Informal Settlements in Nairobi, Kenya. *International Journal of Current Aspects*, 3(4), 131-149. DOI: https://doi.org/10.35942/ijcab.v3iIV.52

Un-Habitat. (2010). *Solid waste management in the world's cities*. Un-Habitat.

Urban Africa Risk Knowledge & African Population & Health Research Centre, (2017). Revealing and responding to multiple health risks in informal settlements in sub-Saharan African cities. *Journal of urban health*, *96*(1), 112-122. Doi: https://link.springer.com/article/10.1007/s11524-018-0264-4

Van, Eerd, (1997). Mobilizing resources to collect municipal solid waste: illustrative East Asian case studies. *Waste Management & Research*, *17*(4), 263-274. https://doi.org/10.1177/0734242X9901700403

Waltz, C. (2004). Two case studies: State BMPs for water conservation on golf courses. *Golf Course Management*, *73*(9), 83-86. http://hdl.handle.net/1853/47339

Wilson, D. C., Rodic, L., Scheinberg, A., Velis, C. A., & Alabaster, G. (2012). Comparative analysis of solid waste management in 20 cities. *Waste management & research*, *30*(3), 237-254. https://doi.org/10.1177/0734242X12437569

Zerbock, O. (2003). *Urban solid waste management: Waste reduction in developing nations. Written for the Requirements of CE, 5993.* https://doi.org/10.1016/j.wasman.2011.03.014

Zhu W., Liu, Gu, B., Wang, H., Chen, Z., Jiang, S., Zhu, M., & Bi, J. (2008). Characterization, quantification and management of household solid waste: A case study in China. *Resources, Conservation and Recycling*, *98*, 67-75. https://doi.org/10.1016/j.resconrec.2015.03.001

APPENDIX I: QUESTIONNAIRE

Kindly fill each of the questions below by ticking the answer that best represents your opinion. Be as honest as possible Section One:

Section A: General Information

1. Gender of the respondent

   a) Male ( ) b) Female ( )

2. Indicate by ticking your age bracket

   a) 24 yrs and below [ ] b) 25-29 [ ]

   c) 30-34 [ ] d) 35-39 [ ]

   e) 40-44 [ ] f) 45-49 [ ]

   g) 50 and above [ ]

3. Kindly indicate your highest level of educational qualification (tick)

   a) Primary education [ ] c) Secondary [ ]

   d) College [ ]

4. How long have you worked as a waste handle in Nairobi County?

   Less than a year [ ]

   1-5 years [ ]

6-10 years [ ]

Over 10 years [ ]

Section B: Types of Waste that are Hazardous to Solid Waste handlers

5. Describe the various wastes that are Hazardous to Solid Waste handlers

   ……

   ……

   ……

   ……

6. What are the major types of waste generated in the County?

   Food Waste ( )

   Plastic Waste ( )

   Biomass ( )

   Paper ( )

   Metallic Waste ( )

Section C: Common Diseases, Attributable to the Dumpsite

7. The following symptoms are attributed to diseases in relation to solid waste management. Indicate the ones which have affected you over the past one month

Fever **[ ]**

Diarrhea [ ]

Coughing [ ]

Head ache [ ]

Skin infections **[ ]**

8. To what extent have the symptoms listed above have affected you?

   Very great extent **[ ]**

   Great extent **[ ]**

   Moderate extent **[ ]**

   Low extent **[ ]**

   Very low extent **[ ]**

9. Has any of your household members suffered from Birth defects and reproductive disorders as a result of working at the dump site?

   Yes [ ] No [ ]

   If yes explain

10. Describe how solid waste disposal sites lead to contraction of related symptoms and diseases

……

……

……

……

11. Do your colleagues who work at the dumpsite suffer from symptoms such as vomiting, diarrhea, and flu

    Yes [ ] No [ ]

    If yes explain

10. How would you rate the prevalence of diseases among your work colleagues at the dumpsite?

    To a very great extent [ ]

    Majorly [ ]

    To a little extent [ ]

    Not at all [ ]

Section D: Occupational Challenges Experienced by Solid Waste Handlers

12. What is your main challenge as waste handler?

……

……

……

……

13. To what extent do would you agree with the following statements on challenges that are being faced by waste handlers

Challenges	**SA**	**A**	**N**	**D**	**SD**
The decommission of organic substances generates methane gas which can bring about fire and explosions, and contributes to global warming and climate change					
Absence of checking of partners demeanor to garbage removal by solid waste administration specialists					
Insufficient/non-requirement of Environmental laws by Waste administration specialists					
Inhabitants' absence of individual obligation to natural security/wellbeing					

Fierce and scaring mentality of waste administration authorities					

14. What do you think are the challenges faced by the County government in in waste management?

    ……

    ……

    ……

    ……

15. In your own opinion, what are other coping measures that are being applied by waste handlers to counter the challenges they face?

    ……

    ……

    ……

    ……

Section C: Risks Associated with Solid Waste picking

16. Describe the health risks associated with solid waste picking at Dandora dumpsite

……

……

……

……

17. The following are some of the physical hazards suffered by the waste pickers. Indicate the ones which are most prevalent

Muscle tear [ ]

Spinal injury [ ]

Head injury [ ]

Eye damage [ ]

18. Describe the exposure of the waste pickers to the health hazards described in question 14 above

……

……

……

……

THE END

THANK YOU FOR PARTICIPATION

APPENDIX II: INTERVIEW GUIDE

1. What type of injuries, accidents and work-related diseases are frequently reported among waste pickers?

……

……

……

……

2. Has there been any fatal accidents/injuries/diseases (resulting in death or disability) amongst waste pickers in the past years?

……

……

……

……

3. Have you ever suffered from any occupational injuries and or illnesses since joining the municipality? Explain

……

……

……

……

4. Explain whether the people who work at the dumpsite suffer from lung, liver and stomach cancers

……

……

……

……

5. What measures have you put in place to deal with safety and health hazards among waste pickers?

……

……

……

……

6. Are there any training programs for waste pickers on safety, health issues and waste handling?

……

……

……

……

7. What do you think can be done, to improve the safety and health of waste pickers?

……

……

……

……

THE END

THANK YOU FOR PARTICIPATION

APPENDIX III: TIME FRAME

Activity	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Chapter one												
Literature review and Methodology												
Field Data Collection												
Data Analysis												
Report Writing												
Submission												

APPENDIX IV: BUDGET

	Items	**UNIT**	**Cost in KSHS.**
1	Stationery, typing papers, pens, flash disk	6	7,200.00
2	Secretarial services	4	8,900.00
3	Printing	7	12,000.00
4	Binding	7	7,000.00
5	Mobile phones expenses	5	8,000.00
6	Communication and telephone Services	4	15,000.00
7	Accommodation and incidentals	4	35,000
	TOTAL	**37**	**91,100.00**

Ethical clearance

KENYA METHODIST UNIVERSITY
P. O. BOX 267 MERU - 60200, KENYA
TEL: 254-064-30301/31229/30367/31171
FAX: 254-64-30162
EMAIL: INFO@KEMU.AC.KE

15TH AUGUST 2019

KeMU/SERC/PHT/72/2019

Timothy Mwangi Nguyai
PHT-3-3556-3/2016
Kenya Methodist University

Dear Timothy,

SUBJECT: ETHICAL CLEARANCE OF A MASTERS' DEGREE RESEARCH THESIS

Your request for ethical clearance for your **Masters' Degree Research Thesis** titled **"Occupational Health Risks among solid waste handlers in Nairobi County."** has been provisionally granted to you in accordance with the content of your research thesis subject to tabling it in the full Board of Scientific and Ethics Review Committee (SERC) for ratification.

As Principal Investigator, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the thesis.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the SERC for re-review and approval **prior** to the activation of the changes. The Thesis number assigned to the thesis should be cited in any correspondence.
3. Adverse events should be reported to the SERC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for SERC review. The SERC and outside agencies must review the information to determine if the protocol should be modified, discontinued, or continued as originally approved.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by subjects and/or witnesses should be retained on file. The

SERC may conduct audits of all study records, and consent documentation may be part of such audits.

5. SERC regulations require review of an approved study not less than once per 12-month period. **Therefore, a continuing review application must be submitted to the SERC in order to continue the study beyond the approved period.** Failure to submit a continuing review application in a timely fashion will result in termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.

Please note that any substantial changes on the scope of your research will require an approval.

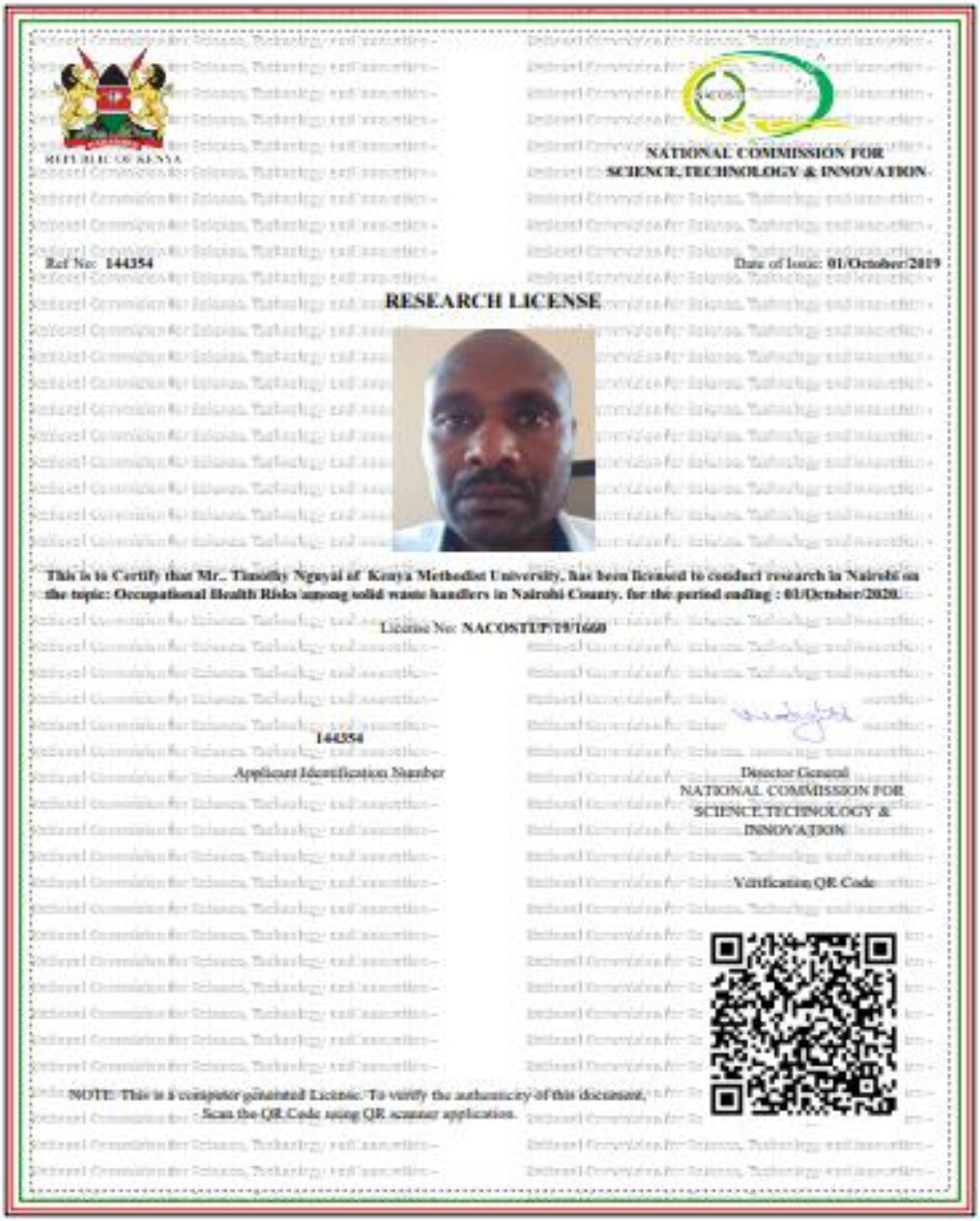
Thank you.

KENYA METHODIST UNIVERSITY RESEARCH & DEVELOPMENT
15 AUG 2019
P.O. BOX 267 - 60200 MERU

Dr. A. Wamachi
Chair, SERC

Cc: Dean, RD&PGS

Research licence



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Date of Issue: 01/October/2019

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This is to Certify that Mr.. Timothy Ngayai of Kenya Methodist University, has been licensed to conduct research in Nairobi on the topic: Occupational Health Risks among solid waste handlers in Nairobi County, for the period ending : 01/October/2020.

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