FACTORS ASSOCIATED WITH NON-COMPLIANCE TO MEDICAL WASTE MANAGEMENT PRACTICES AMONG HEALTH WORKERS AT KENYATTA NATIONAL HOSPITAL - NAIROBI CITY COUNTY

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(Public Health)

JOMO KENYATTA UNIVERSITY

OF

AGRICULTURE AND TECHNOLOGY

2025

Factors Associated with Non-Compliance to Medical Waste Management Practices among Health Workers at Kenyatta National Hospital - Nairobi City County

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

2025

DECLARATION

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

Signature……Date……

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DEDICATION

I dedicate this work to my wife Catherine my two sons Scott and Seth for the moral support encouragement during the period of my study.

ACKNOWLEDGMENT

I first acknowledge the Almighty God for the guidance and protection throughout the years. My sincere appreciation to my research supervisors and mentors, Dr. Dennis Magu and Dr. Daniel Sagwe for constant intellectual inputs and guidance during my academic period.

I am greatly indebted to lectures and staff of JKUAT, for their great support when I needed them. The management of Kenyatta National Hospital for granting me a chance to conduct a study at the health facility.

Thank you all and may God bless you.

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ACRONYMS AND ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CDC	Centers for Disease Control
EMCA	Environmental Management and co-ordination Act (1999)
EU	European Union
GoK	Government of Kenya
HAIs	Hospital Acquired Infections
HB	Hepatitis B
HCFs	Health care Facilities
HIV	Human Immunodeficiency Virus
IPCG	Infection Prevention Control Guidelines
IVC	International Vaccine Centre
KEMSA	Kenya Medical supply Agency
KNH	Kenyatta National Hospital
MDGs	Millennium Development Goals
MOH	Ministry of Health
MW	Medical Waste
NEMA	National Environmental Management Agency
NGO	Non-Governmental Organizations
OECD	Organization for Economic Co-operation and Development

PACE	Performance Analysis Communication and Evaluation
PPE	Personal Protective Equipment
TB	Tuberculosis
UN	United Nations
UoN	University of Nairobi
USA	United Stated of America
USAID	United States Agency International Development
WHO	World Health Organization

DEFINITION OF OPERATIONAL TERMS

Compliance **T**he act of following laws, regulations, standards and ethical practices that apply to medical waste management.

General waste Items that are not considered infectious and can be disposed of by using fairly simple means for example papers.

Hazardous/infectious waste Any waste that is considered to be of special risk, transmit infections to human health of have effects to the environment and therefore needs special management.

Management practices The activities, administrative and operational, that are used in handling ,packaging ,treatment, conditioning, reducing, recycling, reusing, storage and disposal of waste

Medical Waste **W**aste that is generated during diagnosis, treatment, immunization, production or testing of biological products and home based care for the sick, which forms 80% general waste,15% infectious/hazardous waste and 5% sharps.

Segregation Handling practice of separating or an act of dividing a mixture into its component parts for easy management using color codes.

Tracking sticker Written label ,printed or graphic matter on or attached to the container or wrapper of packaged waste.

Treatment Any method ,technique or process designed to change the biological character or composition of medical waste so as to reduce or eliminate its potential for causing harm.

Waste handler Person who's directly involved in medical waste management within the waste stream.

ABSTRACT

The WHO emphasizes measures to manage medical waste mainstream in health. Africa slow pace on development has documented evidence on health impacts associated with medical waste, Kenya, is not an exceptional since all the 47 counties are struggling to manage the medical waste.The objective was to determine medical waste management practices among health workers in KNH. A cross-sectional study design was used, stratified proportionate sampling was used to select desired sample size297 respondents. Self-administered questionnaire used for data collection and analysis done using R 3.6.0 statistical program.52% were Female, 53% were nurses, 38% of the respondents had worked for a period between 5 and 10 years, (67.3%) used color codes correctly when segregating waste, 89.6% maintained a routine schedule in medical waste collection,60% of the respondents were not vaccinated, (89%)highlighted being issued with PPE,(74%) experienced an injury while handling medical wast. Statistical associations between years of working and segregation of medical waste generated, $X^2(3) = 43.25$, $p = 0.000$, $p<0.05$,department and schedule for collecting medical waste($X^2(7) = 31.043$, $p = 0.005$, $p<0.05$),cadre and vaccination/treatment compliance ($X^2(3) = 25.57$, $p = 0.000$, $p<0.05$),cadre and PPE compliance($X^2(3) = 11.36$, $p = 0.001$, $p<0.05$)and between cadre and reporting of an injury experienced during handling medical waste($X^2(l3) = 30.54$, $p = 0.001$, $p<0.05$). The results identified gaps in compliance practices while incinerating waste and following safety measures in place, hence creating awareness among Health workers while handling medical waste and timely repairs of incinerator plants so as to comply with medical waste practices in the Hospital.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Medical waste is any waste which is generated during diagnosis, treatment, immunization of human beings or animal, categorized into general waste which forms (80%) of the generated waste, infectious waste (15%) sharps (5%), if mismanaged along the main waste stream can lead to serious safety issues to human health and environment (WHO, 2012). A lot of differences exist in the way medical waste is handled globally with poor practices often noticed in low and middle-income countries (Caniato *et al.*, 2015). However, proper segregation of waste is very crucial in making medical waste disposal cost-effective and safety assurance to handlers.

In Europe, production of hazardous waste can be traced as far back as the blacksmith era. The threat of hazardous waste, however, grew immensely with increased industrialization, improvement of technologies and production of industrial chemicals. It was not until 1980 that the challenge of disposing of hazardous waste in a safe manner was confronted. This was aimed at fighting contamination of soils, water and air. The European Economic Community (now the EU) enforced laws on hazardous waste management. That year, the Organization for Economic Cooperation and Development (OECD) also adopted the legislation on wastes in the ’80s (Samuel & Mutuku , 2014).

In the USA, the evolution of a separate category of clinical waste management in the waste stream dates back to the late 1970s. This is when clinical waste including syringes and bandages were washed up on USA east coast beaches that lead to massive death of aquatic life and potential risks to the beach users, this lead to the formulation of the USA clinical waste tracking Act which was enforced on November 1, 1998 (Patwary *et al.*, 2011).

In most of the developing countries, limited options exist for safe medical waste disposal, especially for used or contaminated sharps that can lead to injury and if these

wastes are disposed of in an indiscriminate way, they can pose safety and risks of infection at significant levels. This results in waste management being complicated since mixing sharps and other wastes that are infectious with non-infectious waste will lead to an increase in the amount of waste considered to be infectious which requires special handling for a safer way of treatment and disposal (GoK, 2015).

An assessment of medical waste management in seven hospitals in Lagos, Nigeria revealed that the hospital did not quantify medical waste, separation of medical wastes into those that could cause medical infections and non-infectious medical waste was not conducted according to the laid down rules and standards (Awodele, *et,al* 2016).Wheeled trolleys were used for on-site transportation of medical waste from the production point to the temporary storage area. The staff that was allocated the responsibility for collecting medical waste used almost complete personal protective equipment. Transportation of the hospital waste to the off site point was outsourced from a private waste management company and small trucks referred to as pickups were the main modes of transportation used to move waste daily to an off-site area for treatment and disposal (Mmereki *et,al,*2017). The main treatment method used in the final disposal of medical waste was incineration (Kuchibanda *et, al.* 2015).

A study on medical waste management practices among health workers in the health facilities of Gondar town, Northwest Ethiopia in 2013 indicated that there was no waste separation in most studied health care facilities. The mode of storage, transportation and disposal of medical waste was inappropriate in all surveyed health care facilities (HCFs). This has resulted in the health facilities becoming greater than ever to address the basic health needs of the society and to achieve the Millennium Development Goals (MDG) (Debere *et al.*, 2013).

Medical waste generation is continuous as health workers attend to patients. The generation of medical waste per patient per day is about 0.5kgs (Manar *et al.*, 2014), hence without adequate waste disposal options at both National and local levels, this volume of waste would be difficult to eliminate safely (Debere *et al.*, 2013). Kenya has grappled with the problem of management of medical waste ranging from inadequate supplies needed for the management to Cultural, attitudes and risk practices

of not using the right PPE when expected hence there has been an ineffective and also poor management of medical waste from health facilities (MoH, 2016). While the rest of the medical waste is handled in a special way by the counties, medical waste poses serious challenges like needle pricks injuries, smoke emissions due to open burning and breeding sites for vectors, vermin's and rodents which are media for diseases (Samuel and Mutuku, 2014).

Increased generation of diverse types of medical waste is due to addition and expansion of health facilities as a result of an increase in population, continued immunizations and treatment of various emerging and re-emerging of communicable and non-communicable diseases. Without proper segregation and treatment practices, the health workforce, the environment, and the community at large are exposed to potential health risks. This may also lead to Hospital Acquired Infections (HAI's) among health workers and patients which contributes to morbidity and mortality burden in the developing world (GoK, 2010).

In Kenya, there is no accurate quantification of the actual burden of HAIs. However, the projection has been approximated to about 10% to 25% of hospital admissions in government health facilities, 2.5% of HIV infections in health workers, 32% of hepatitis B cases, and 40% of hepatitis C cases (WHO, 2010). Also of importance to note is the health workforce and the general public are exposed to a great threat of viral hemorrhagic fevers (Ebola) and multidrug-resistant TB. Hence

KNH has developed health waste policy to address medical waste management challenges (KNH, 2015). In many urban centers in Kenya, waste management involves poor on-site, storage, lack of on-site separation facilities, poor or unavailable formal waste transport system, lack of formal waste transfer stations, poor formal recycling practices, plants and lack of appropriate waste disposal site thereby encouraging the dumping of wastes in a crude way and burning wastes in the open. Waste managed in the above manner produces offensive smells, releases dioxins when burnt, acts as rodent and insect breeding sites and portrays a poor aesthetic picture of the environment resulting in risk to both Public and Environment (GoK, 2015).

Once visualized, a situation in typical hospital in Kenya today, there is often an influx of supplies into the hospital from Kenya Medical Supplies Agency (KEMSA), visitors, patients and staff. These medical supplies when used in a hospital setting end up as medical waste. This waste is commonly dumped crudely by roadsides, streets, streams and quarries. Some improved disposal means include burning or incinerating either of which emits poisonous gases (Samuel and Mutuku, 2014).

The right to life and the right to treatment in a health facility are enshrined in the Kenya constitution (2010). Unfortunately, health facilities while undertaking their missions of reducing health problems and eliminating potential risk to people's health it generates waste which may be considered as a hazard to human health (GOK, 2015).

1.2 Statement of the Problem

The non-compliance on medical waste has been a major challenge globally considering the existing diverse guidelines that health facilities employ. Compliance entails effective waste management practices during generation, segregation, collection, handling and incineration/treatment. Non-compliance to medical waste practices leads to safety measures among health workers. (Ali, et, al.2020)

Several cohort studies have been conducted and outcomes have been associated with needle pricks and patients body fluids have been confirmed to cause 1.7m (45%) cases of Hepatitis B and C viruses, 400,000 (9%) new HIV infections, 10million annual TB infections with estimated 3 million cases among health workers in the hospitals and from home-based care givers due to mishandling of medical waste (WHO, 2020).

Recognizing the magnitude of this problem many developing countries in the Continent of Africa and the sub- Saharan have responded through establishment of regulatory frame works, polices and medical waste plans but still greater challenge of under-funding towards management of medical waste has exposed health workers on hospital acquired infections and polluting the environment (CDC,2019).

A third of public hospital and a fifth of private ones in Kenya do not manage their medical waste in a safe recommended way leading to health risks in both health

workers and the population that makes a living through scavenging along the waste stream (GOK,2021). Taking into account that KNH is the largest National referral hospital in Kenya with over 2000 bed capacity and over 1000 outpatient clients seeking health services per day leading to the generation of 2 tons of medical waste per day that need to be managed properly, With non-compliance on medical waste will act as a media in spreading infections among handlers ,polluting the environment and contamination of the water bodies which will have an effects on the food chain. The study seeks to find out the segregation practices, safety measures while handling medical waste and during final treatment among handlers.

1.3 Study Justification

Medical waste is an important part of hospital hygiene that leads to prevention and control of risks and infections, improper management can cause serious harm to health workers, patients and the environment (WHO, 2017, GOK,2010). Trends on records obtained from KNH of health workers who sought for post exposure prophylaxis treatment in 2017 were 32% and within the same period those vaccinated against HB infection were 22%and both services were offered free for staff working at the hospital (KNH,2017). Both PEP and HB vaccination are key safety measures for medical waste handlers in case of needle prick injury or spillages associated with medical waste management practices that lead to conducting the study at KNH.

Therefore the study was to determine compliance or non-compliance in medical waste practices among health workers subsequently align the findings together with recommendations to comply with WHO standard on medical waste management (GOK,2015). Basing on the study findings and recommendations there is need for the hospital to enforce compliance in the available strategies to improve on compliance in medical waste management among health worker in the hospital.

The Kenyatta National Hospital management will immensely benefit on implementation of the highlighted recommendations which will also reduce the turnaround time of health workers seeking medical services that are related to non-compliance of medical waste practices and legal penalties, nationally it will be a key tool in policy formulation.

1.4 Objectives

1.4.1 Broad Objective

To determine factors associated with compliance or non-compliance of medical waste management practices among health workers at Kenyatta National Hospital in Nairobi County.

1.4.2 Specific Objectives

1. To determine factors associated with compliance or non- compliance to segregation of medical waste at Kenyatta National Hospital.
2. To determine factors associated with compliance or non-compliance in treatment of medical waste at Kenyatta National Hospital.
3. To determine factors associated with compliance or non- compliance on safety practices while handling medical waste at Kenyatta National Hospital
4. To determine factors associated with compliance or non- compliance to collection of medical waste at Kenyatta National Hospital

1.5 Research Questions

1. What are factors associated with compliance or non- compliance to segregation of medical waste at Kenyatta National Hospital?
2. What are factors associated with compliance or non-compliance in treatment of medical waste at Kenyatta National Hospital.
3. What are factors associated with compliance or non- compliance on safety practices while handling medical waste at Kenyatta National Hospital
4. What are factors associated with compliance or non- compliance to collection of medical waste at Kenyatta National Hospital

1.6 Conceptual Framework

The study aimed in understanding factors associated with compliance or non-compliance of medical waste management practices based on different levels. Thus, there was focus on independent and dependent variables which presented an

understanding on the existing relationship. The independent variables that were investigated in the study included generation, segregation, collection, treatment and safety measures. In assessing generation of waste, there was emphasis focused on different types of waste generation which included infectious, hazards, sharps and general waste. Segregation assessed understanding on type of waste and subsequent segregation using color code which included yellow, red, black and safety box. Collection assessed the frequency of collection while safety measures explored on HB vaccination used PPE and reasons of non-compliance on the same. The dependent variables focused on factors associated with compliance or non-compliance of medical waste practices among the health workers. The main limitation identified during the study was time constrains of which research assistants were employed and distributed the questioners in the vast health institution.

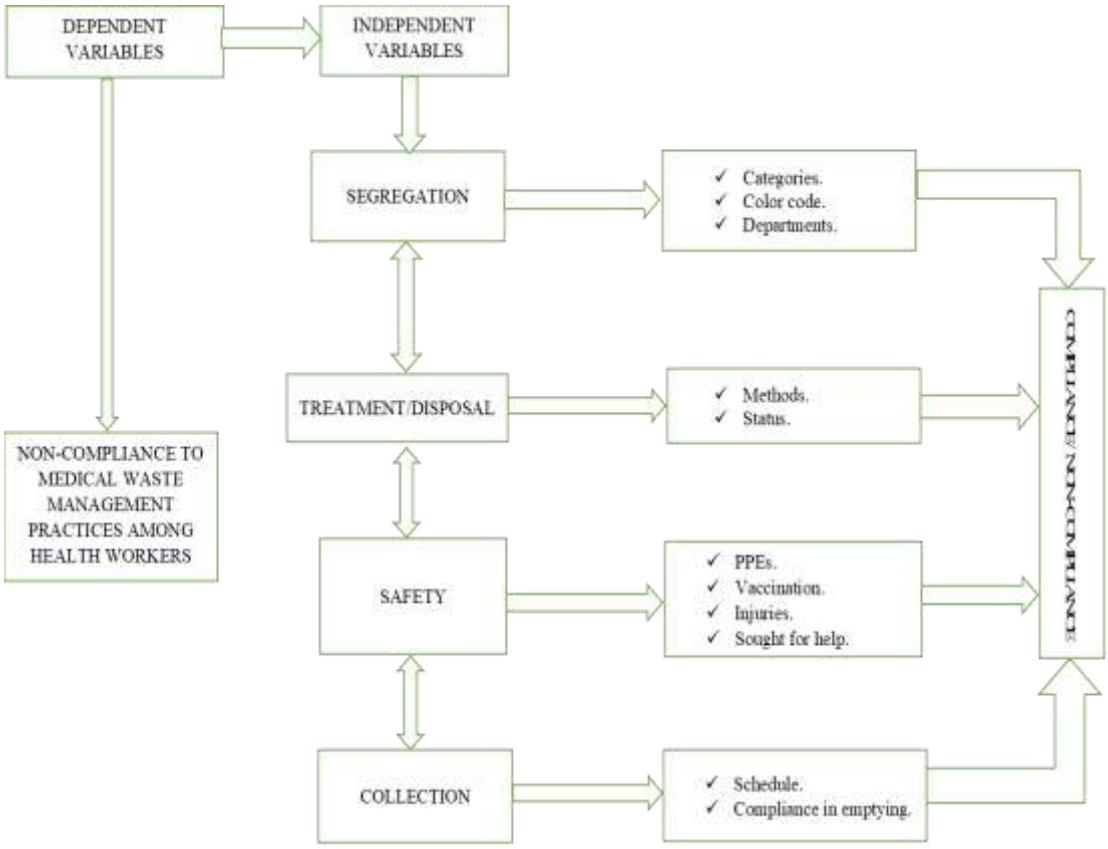

Figure 1.1: Conceptual Framework on Compliance to Medical Waste Management Practices among Healthcare Workers.

Source: (WHO, 202O)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Medical waste is a by-product generated in a health facility during diagnosis, treatment and carrying out of research it also includes waste generated in the course of health care undertaken in the homes like self-administration of insulin and recuperative care, which includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals and radioactive materials. Poor management of medical waste exposes health workers, patients and the community to infections, toxic effects and injuries it may also pollute the environment (WHO,2014). When medical waste is not managed properly the health workers are exposed to contamination risks, occupational accidents and illnesses for being constantly exposed to microorganisms, some of the examples of infections caused by exposure to infectious waste are gastro enteric, skin and genital infections, anthrax, acquired immunodeficiency syndrome, hemorrhagic fever and hepatitis A, B and C. (Ranjan *et al*, 2016).

Environment problems may also arise due to foul odors, flies, cockroaches, rodents and vermin, with poor treatment of medical waste leads to emissions of toxic and persistent compounds such as dioxins and furans (GoK 2015).

2.2 Segregation Practice on Handling Medical Waste among Respondents

Generally, there are key steps associated with handling of medical waste in health care facilities that includes- generation, segregation, collection transportation treatment and disposal.

The medical waste generated in a health facility ranges from general waste, such as papers food remains that is also non-infectious, infectious waste such as syringes and needles to highly infectious waste like anatomical body parts to hazardous categorized as special waste that contains mercury from broken thermometers and body imaging films (WHO,2014).

Around 80% of the medical waste is nonhazardous and 15% is infectious while the remaining 5% is made up of sharps, 1% toxic chemicals, pharmaceuticals 3% genotoxic and radioactive waste forms 1%. These traditional estimates are not consistent for many developing countries where in Kenya due to poor segregation practices it is common to find that up to 50% of the generated medical waste in some health facilities is infectious (MOH, 2015).

The generation of medical waste should take place with very close proximity to the generation site, and should always be guided with proper and preferable way of identifying waste categories to ease sorting them into color-coded bags or containers (WHO, 2010a).

A cross-sectional study conducted in Ethiopian 2011 to quantify health waste generation rate and evaluate its management system in governmental health centers in Addis Ababa revealed that the mean health waste produced was 0.5 kg/patient/day and 1.6 kg/bed/day (Debere *et al.*, 2013).

Segregation of waste at the site of generation is the first and foremost important step in medical waste management. It is emphasized as a means of ensuring that hazardous health risk waste and general medical waste are separated and stored in appropriate containers. The importance of segregation is highlighted by the mere fact that about 10% to 25% of waste generated in health facilities is hazardous (Pant, 2012). Failure of these vital steps turns nonhazardous waste into hazardous. Segregation also enables those who handle the containers outside the hospital setups to identify and treat them appropriately.More so segregation makes categorization and quantification necessary to enable decision- making on safe and effective treatment also supports health-care minimization, supports environmental protection efforts, occupational safety and regulatory compliance. Source reduction of health-care waste is, therefore, a necessary undertaking that may support this endeavor. It encompasses material elimination change or product substitution, technology or a process change, good operating practice and preferential purchasing 'green purchasing" (WHO, 2010).

The different estimates regarding the share of general and hazardous constituents of medical waste generation are due to the segregation of medical waste at the point of

generation is weak in health facilities and assumed these wastes are not contaminated and therefore they do not pose a risk of infection. Such management of the medical waste is done by traditional ways and some of the medical waste disposal to be in-forced by the goodwill of managers. Another assumption is the limitation of existing facilities, lack of adequate institutional arrangements, operational insufficiency and local authorities inefficiency in performing their tasks effectively are some points for the poor management but few take proper care of their waste (WHO, 2011).

Various color-coding schemes are used in the United Kingdom and safe disposal of clinical waste recommends the following colors Black for general waste, yellow for all waste destined for disposal by other means for example landfill and light blue for waste to be pre- treated before ultimate disposal. World Health Organization recommends yellow-marked "Highly infectious" for infectious waste, brown for chemical and pharmaceutical waste and black for general waste (WHO, 2014).

The most appropriate way of identifying the categories of medical waste is by sorting the categories of waste into color-coded plastic bags or containers. The recommended color-coding system in Kenya as per the WHO regulations is in table 2.1.

Table 2.1: Color Codes System Used in Kenya

Type of waste	Color of container and markings	Type of container
Sharps	Yellow (marked sharps)	Puncture proof
Infectious	Yellow	Strong leak-proof plastic bag with the biohazard symbol
Highly infectious	Red (marked highly infectious)	Containers capable of being autoclaved
Non-infectious/nonhazardous(non-clinical)	Black	Plastic bag or container
Chemical and pharmaceutical	Brown	Plastic bag or container
Radioactive waste	Yellow with a black radioactive symbol	Lead box

Source (MoH, 2016)

For the bins to be used well it is necessary to ensure clear labeling of bags and containers, to differentiate between waste categories by the use of posters and stickers or printed bins and liners should help the members of staff, patients and their visiting relatives to segregate the waste (MoH,2016).

Collection of medical waste on-site requires the responsible staff to tie up the medical waste bags when they are three-quarters full by tying the neck or by sealing the bag. Routine program for their collection should be established as part of the medical waste management plan with recommendations to ensure that medical waste is collected as frequently as required, transported to the designated site or storage areas and to ensure daily requirements for medical waste bags supply (MoH, 2016).

A descriptive cross-sectional study carried out in Nairobi County Kenya on the awareness and practice on medical waste management where (92.3%) of the respondents reported they have a routine schedule for collecting medical waste , higher (99%) noted that collection was done daily then (53.3%) of the respondents noted they empty the containers when (3/4) full (Njiru, 2015).

Medical waste should be treated prior to disposal so as to ensure protection from the potential hazardous posed by these wastes, to be effective treatment must reduce or eliminate the risk present in the waste so that it no longer poses a hazard to persons who may be exposed to it, the common treatment method used include incineration, steam sterilization, autoclave and microwave irradiation. Each health facility should adhere to medical waste proximity principal where treatment and disposal of hazardous waste take place at the closest possible location to its source and polluter pays-principle which states that medical waste producers are legally and financially responsible for the safe handling and environmentally sound disposal of the waste they produce(GoK, 2015).

At present, there are practically no environmentally friendly low-cost options for safe treatment of infectious waste but they can be managed whether generated at smaller rural clinics or larger facilities where adequate well-operated infrastructure exists (WHO, 2010b). In advanced countries, the common methods used for medical waste treatment include steam, sterilization, autoclave and incineration (Patwary *et al.*, 2011).

In the UK, treatment technologies fall into two main categories, high-temperature incineration/combustion and no-burn or low-temperature alternative technologies (Caniato *et al,* 2015). In Canada, there has been a shift from on-site incinerators towards centralized facilities that handle medical waste generated over a wide geographical area. The approach aims to reduce air pollution resulting from on-site incineration (Walkinshaw, 2011).

Africa is estimated to have 67,740 health facilities and produce approximately 282,447 tons of medical waste every year (Komilis *et al.*, 2012). However, the waste stream that is composed of potentially hazardous materials that may require special treatment may be higher than the expected 10 to 25% because of poor waste handling practices that are reported in many studies(Mohankumar *et al.* 2011). Studies in Africa indicate the continent is not positioned to tackle the quantity of hazardous waste it produces where much of waste is dumped in open dumps and poorly functioning incinerators (Saad, 2013).

A cross-sectional study carried out in Ghana to assess placenta management in labor wards revealed that 0.4% traditional practices affect the disposal management of medical wastes where by placenta was taken home to bury in line with traditional or religious practices. An interesting dimension is where placenta pits are fed with acid digestive to prevent them from getting full hence posing a great danger to groundwater table in shallow and soil porosity which permits easy percolation (Joshi, 2013).

In line with NEMA regulations 2016, on waste management indicate that treatment plants shall be located in an ideal space away from water bodies, distance from the residential areas, allocated adequate resources well as staff training most importantly respect of good practice also regular monitoring and maintenance checks not limited to stack emission analysis to ensure the smoke emitted from the plant complies recommended standards.

A study conducted in Turkey determined that concentration in combustion gas were higher from the sampled incinerators with 93 to 710 times higher than the EU –legal limits (0.1 ng TEQ/M^2) went further to recommend for the use of catalytic filter

technology that removes dioxins and furans along with particulate matter which is cost-effective(Njagi *et al*,2012) .

Small scale locally built incinerators appear unlikely to meet emission limit for carbon monoxide particulate matter, dioxin, furans, hydrogen chloride and possibly several metals and other pollutants(WHO,2010b). Proper operation and maintenance will improve equipment reliability and performance, prolong equipment life and help to ensure proper ash burnout Regardless of how well equipment is designed wear and tear during normal use and poor operation and maintenance practices will lead to the deterioration of components resultant decrease in both combustion quality and increase in emissions and potential risks to the operator and public. Operation and maintenance also affects reliability ,effectiveness and life of the equipment. Essentially all components of small scale incinerator are prone to failure and require maintenance schedule (Mmereki *et at*, 2017).

An additional challenge is when the incinerator machines operate in low temperatures $<200^0$C resulting in the excess generation of toxic gases like CO, HCL, dioxins, and furans. Since these facilities are located close to community areas, the emissions from the incinerators present a serious health risk to the same communities and localities which the hospital is meant to serve (Awodele *et al*, 2016).

2.3 Safety Measures while Handling Medical Waste among Respondents

Each health facility is responsible for providing a safe, healthy workplace and safe systems of all workers Management of medical waste presents a number of potential hazards to employees requiring the appropriate measure of risk identification, risk assessment and risk control. Each health worker have an obligation to follow instructions regarding safe practices while the employer to provide appropriate information, education, training and ensuring that safety systems of work are developed and maintained (MoH, 2017).

The health worker are exposed to hepatitis viruses and HIV infections while handling medical waste hence safety measure are key to prevent the risks. It is recommended that health workers to get routine immunization against HBV which is the most

infectious blood-borne virus, where an assessment to exposure is done to determine the immune status if possible collect a specimen from the medical waste and the exposed waste handler for HBsAg testing, for the first dose of HBV Vaccine which should be repeated at one and six month and should be given within seven days of exposure (MoH, 2013).

Post-exposure prophylaxis, also known as post-exposure prevention, is any preventive medical treatment started after exposure or pricked by contaminated needle while handling medical waste to prevent one from HIV/AIDS (WHO, 2017).

The literature source advocate for importance of all medical waste to be tagged with unique reference number which is traceable to the point of production where closure ties that in- cooperate a reference number system are extensively used, in-case of incident this will allow each package to be traced to the actual generation point and for accountability (GOK, 2010).

A study conducted in Akure Nigeria on medical waste management in 7 hospital where 94% n=120 of the respondents had not used or seen the tagging on medical waste bags(Olufursho *et a*l,2016).Further an assessment conducted by (MOH and USAID under the PACE project in 2012) revealed that 88.7% n=80 had not labeled/tagged the generated waste only 12.3% n=20 facilities had complied posing serious challenges in tracing the medical waste.

The personal protective equipment's are aimed to protect the user against health or safety risks at work, which include items such as safety helmets, gloves, eye protection high visibility, clothing, safety footwear and respiratory protective equipment. The employers have duties concerning the provision and use of PPE at work for free (GOK, 2010b).

The PPE provides a physical barrier between microorganisms and the wearer thereby preventing microorganisms from contaminating hands, eyes, clothing, hair and shoes. PPE also prevents microorganisms from being transmitted to other patients and staff. It should be understood that PPE is the last option in hierarchy of hazard controls and should only be used if elimination, engineering controls and or changes to work

practices do not adequately remove/reduce the risks (GOK, 2011).Due to infections, injuries and foul smell arising from medical waste; it is necessary for health workers to wear personal protective equipment and gears (Yawson, 2015).

The study conducted by (Wafula, 2012) where 98% of health workers at health centers in Nairobi county use gloves and 95% use masks, however only 40% wear an apron and 30% use laboratory coats, in contrary 90% of the health workers with another study conducted at Offinso Municipality, Ghana highlighted that waste handlers in the hospital did not use gloves as protective wear during medical waste handling nor use any other protective wear was used (Yawson, 2015). In Gondar town, Northwest Ethiopia, the majority of the health workers 93.1% use gloves during medical waste (Muluken *et al.* 2014).

2.4 Factors Associated with Non-Compliance in Collection of Medical Waste among Respondents

All individuals exposed to hazardous MW are potentially at risk including those within health establishment that generate these wastes and those outside these sources who either handle such waste or exposed to it as a consequence of noncompliance. The main groups at risk are medical doctors, nurses, subordinate staff and hospital maintenance personnel, patients in a health establishment, visitors, workers in areas such as laundries, waste handling, transportation and also in waste treatment facilities including scavengers and totters (Hossain *et al.*, 2013).

The scavengers have professionalized unauthorized recycling of waste material from dumps and this act puts them at risk from sharp objects, pharmaceuticals and chemicals and by coming into direct contact with infectious materials. Recycling of infectious objects poses a serious health hazard to users. Scavengers engaged in recycling mostly are extremely poor, ill-educated and unaware of the harmful consequences of exposure to contaminated and hazardous waste. They evidently suffer injuries from sharps and broken glass among other things, as well as suffering from intestinal parasitosis, skin disease, diarrhea, chronic dysentery and viral hepatitis (Hosyn,*et al* 2018).

In Tanzania, Shinyanga municipality, MW is disposed of in the open community bin along with the normal waste which is commonly scavenged by boys/girls without any precaution which might cause health hazards and infectious disease (Kuchibanda *et al*, 2015). A cross-sectional study carried out in Namibia on knowledge, attitude and practice among the health workers revealed that they must be educated on the risk in order to improve their practices with regard to MW management since they are required to carry out the expanded role in a variety of settings. They have to be ecologically sensitive in assessing the impact of their practices on the environment and how to provide ways to reduce the hazards (Manchanda *et al.*, 2015).

A three-year study carried out in Jordan found out that in 1000 people involved in patient-related activities, 248 health workers had needle prick injuries of which 43.1% were nurses, 19.1% were environmental workers, 15.7% were interns, 11.7% were residents and 6.0% were technicians. The study concluded with an association in management compliance of needle-stick injuries occur frequently to nurses, physicians, technicians and support staff in developing countries (Patwary *et al.*, 2011).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Site

The study was conducted in Kenyatta National Hospital (KNH) level 6 public teaching and referral hospital founded in 1901, located in Nairobi county 4km from the city center with longitude and latitude of 1.3013^0S,36.8070^0Ealong Ngong road. It borders University of Nairobi (college of health sciences), Kenya Medical Training College (KMTC), Kenya Medical Research Institute (KEMRI), National Public Health Laboratories (NPHLS), National AIDS and STIs Control Program (NASCOP) and National Blood Transfusion Services (NBTS) (Figure 3.1). The current bed capacity is 2000 beds and over 4000 staff within 35 departments and 23 units. Annual budgetary allocation for 2019-2020 totals of Ksh40 billion (KNH, 2019).

The public health officer in the institution play a key role in management of health care waste from generation to the final disposal site.

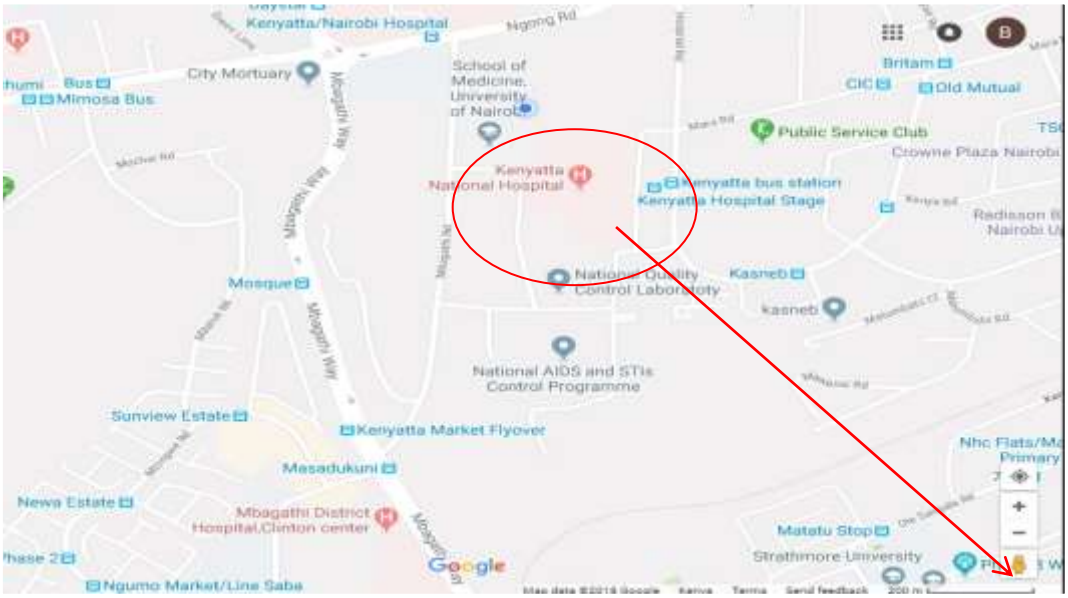

Figure 3.1: Map of Nairobi County Showing the Study Site

Source: Google Map 2019, site Key-H-Position

3.2 Study Population

The study population comprised of health workers at KNH, who are directly involved in medical waste practices. . They included doctors, nurses, laboratory technologists and support staff.

3.3 Inclusion and Exclusion Criteria

3.3.1 Inclusion Criteria

Health workers who:

i.) Must have worked in the hospital for more than one (1) year.
ii.) Those who consent to participate in the study.

3.3.2 Exclusion Criteria

The health workers;

i.) On leave.

ii.) Not willing to participate in the study.

3.4 Study Design

This was cross-sectional study-was chosen because of limited time and budget constrains to determine factors associated with non-compliance of medical waste handling practices,which was achieved through a structured questionnaire capturing current data from the study respondents at KNH.

3.5 Study Variables

3.5.1 Independent Variables

These are factors that are manipulated,changed to observe the effects which include management practices,segregation practices,collection practices,treatment practiand safety measures practices.

3.5.2 Dependent Variable

- Non-compliance on medical waste management practices

3.6 Sampling and Sample Size Determination

3.6.1 Sample Size Determination

The sample size was determined by the use of standard Fisher's formula (Fisher *et al* 1999).

$$n = Z^2pq/d^2$$

Where:

n Is the desired standard sample size (if the target population is greater than 10,000)

Z 1.96 level of significance obtained from the table (z score corresponding to a 95% confidence interval).

p 60% of the health workers at risk from non-compliance on medical waste management previous study carried out by Kenya performance analysis communication and evaluation (PACE) project for USAID/MoH (MoH and USAID, 2012).

q 1-*p* = proportion of the target population without the characteristics of interest.

d 0.05 (5%) margin of error to be tolerated in the study.

Calculation of the sample size:

$$n = \frac{96^2 \times 0.6 \times 0.4}{0.05^2}$$

$$n = 369$$

Since the target population is less than 10,000 staffs (i.e. 1,000 staff), the sample size was adjusted downwards using finite population correction factor (f.c.f.) as follows;

$$n_{f.c.f} = \frac{n}{1+N}$$

Where $n_{f.c.f}$= the minimum desired sample size if the population is less than 10,000.

$$n = \frac{369}{1 + \frac{369}{1000}}$$

$$n_{f.c.f} = 270$$

For non-response the sample size was adjusted to 297 respondents.

3.6.2 Sampling Procedure

Stratified proportionate sampling was employed where a list of targeted departments and the total number of the targeted population in each cadre was developed. Departments as strata included Casualty, orthopedic, general surgery, Reproductive health, Medicine, Pediatrics, Incinerator and laboratory. Cadres: doctors, nurses, laboratory technologist and support staff. The study unit from each strata and cadre was acquired randomly through totaling study population then divided with target population and then multiplied with desired sample size, with the outcome, the first respondent was selected randomly, then using the K^{th} formula (N/n) which guided on skipping interval for subsequent respondent until the actual number of 27 doctors, 152 nurses, 53 lab tech and 65 support staff is attained (Table 3.2). They were administered with questionnaires to fill.

Table 3.1: Distribution of Respondents in the Departments

KNH	A/E	Ortho	G.S	RH	Med	Paeds	Inc.	Labs	Total	
Doctors	14 (4)	10 (3)	14 (4)	20 (6)	18 (5)	14 (4)		5 (1)	95	27
Nurses	117 (35)	70 (21)	66 (20)	110 (33)	58 (17)	87 (26)			508	152
Lab Tec								180 (53)	180	53
Support staff	33 (10)	27 (8)	30 (9)	35 (10)	24 (7)	29 (9)	26 (8)	13 (4)	217	65
Totals	**164 (49)**	**107 (32)**	**110 (33)**	**165 (49)**	**100 (29)**	**130 (39)**	**26 (8)**	**198 (58)**	**1000**	**297**

Abbreviations A/E-Accident and Emergency, Ortho- Orthopaedic, G.S- General Surgery,- RH- Reproductive Health, Med-Medicine, Paeds-Paediatrics, Labs-Laboratories, Inc-Incinerator, Lab Tec - Laboratory Technician

Source: (Duty Rosters in Departments/units –June 2018)

3.7 Data Collection Process

The self-administered questionnaires and a developed checklist were used, the questionnaire contained four sections. Section **A** was used to collect the demographic information of the respondents such as gender, profession, department, ward and duration of working in years. Section **B** was used to establish data on medical waste handling practices which included collection, segregation and generation. Section **C** used to collect safety practices while handling medical waste that included, use of personal protectives treatment of waste, vaccination to HBV, and treatment to post exposure prophylaxis

3.8 Recruitment and Consenting Procedures

The medical waste handlers who include, doctors, nurses, laboratory technologist and support staff working at casualty, orthopedic, general Surgery, reproductive health, medicine, pediatrics, laboratories and incinerator were politely and privately approached during working hours by the principal investigator and research assistants, informed about the study and permission sought to take part in it.

As per the appended information and consent form, the study only involved participants who read, understood, accepted to be part of the study and duly signed the consent form. The participant's confidentiality was maintained throughout the process.

3.9 Pre-Testing of Data Collection Tools

3.9.1 Validity

The questionnaire was established and evaluated on it is face value validity with the questions in relation to study objectives.

3.9.2 Reliability

The pilot study was conducted which yielded the same result in the main study, with the problem of duple numbering of the questionnaire was corrected and the scope of the study come out very clear.

3.10 Data Management and Analysis

3.10.1 Data Cleaning and Entry

The support of a qualified statistician cross-checked and filled questionnaires to ensure that they were accurately filled and excluded questionnaires that were not completed successfully. Collected data was entered in Epi-Data 3.1.

3.10.2 Data Storage

The questionnaires were coded. Once they were filled they were locked up in a safe cupboard. The laptop that was used in the analysis of the data had a password to ensure limited access by authorized personnel only. The consent forms and questionnaires will be safely stored for five years after which they will be destroyed.

3.10.3 Data Analysis and Dissemination of the Findings

Data was organized, cleaned, coded and evaluated for accurateness in preparation for analysis using the R 3.6.0 statistical program. Descriptive statistics were done by calculating proportions and percentages, to compute demographic information. Inferential statistics using chi-square was done to assess significant associations between dependent and independent variables with additional Binary logistic regression model and spearman's to check correlation The results presented in form of tables, graphs and pie-charts.

3.11 Ethical Consideration

An approval to conduct the study was issued from KNH-UoN Ethics Review Committee (P469/07/2018). Permission to collect data was sought from hospital authorities and from the department/unit in charge before starting the data collection process.

Informed consent: Written informed consent (Appendix 1) was obtained from each participant legally authorized individual before any protocol-specified procedures being conducted. **Confidentiality:** To maintain confidentiality, initials and coded

numbers were used to identify the participants. All study records were maintained in a secured location. The data collected in this study was purely for research purposes. Participants were assured of confidentiality that their names will not appear in any report.

CHAPTER FOUR:

RESULTS

This section provides an understanding on the results from the analysis based on the objectives that were being investigated.A sample of 297 respondents was recruited across different departments from which 272 were well answered and returned for analysis representing 92% response rate.

4.1 Socio- Demographic Characteristics of Study Respondents

The results showed that 51 % (140) were female while 49 %(132) were male. The cadre of the respondents was also assessed, 53% (144) were nurses, 21 %(n 57) were support staff, 18 %(50) were laboratory technicians while 8% (21) were doctors. Departmental affiliation showed that 18% (49) were from laboratory, 17% (47) from reproductive health, 17% (46) were from accident and emergency department, 13 %(36) from peadiatrics.11%(30) from general surgery, 10% (26) from medicine, while 3% (8) from incinerator. Period worked in the hospital showed that 38%(102) of the respondents had worked for a period between 5 and 10 years while 32% (88) had worked in the hospital for a period between 10 and 15 years, 26% (70) worked between 1 and 5 years while 4% (12) had worked in the hospital for a period of more than 15 years as shown in Table 4.3.

Table 4.1: Socio Demographic Characteristics of Respondents.

Social characteristics	Frequency (n =272)	%
Gender		
Female	140	51
Male	132	49
Job cadre		
Nurse	144	53
Support staff	57	21
Laboratory technician	50	18
Doctor	21	8
Department		
Accident and Emergency	46	17
Laboratory	49	18
Reproductive health	47	17
Pediatrics	36	13
Orthopedics	30	11
General surgery	30	11
Medicine	26	10
Incinerator	8	3
Period worked at the hospital		
1 to 5 Years	70	26
6 to 10 Years	102	38
11 to 15 Years	88	32
Above 15 Years	12	4

4.2 Handling of Medical Waste among the Respondents

4.2.1 Categories of Medical Waste Generated among the Respondents

Majority, 67% (182) of waste generated was general waste, more than half, 53% (143) of the waste generated was infectious waste,then 49 %(134) of the waste was hazardous while 46% (124) were sharp as represented in figure 4.3.

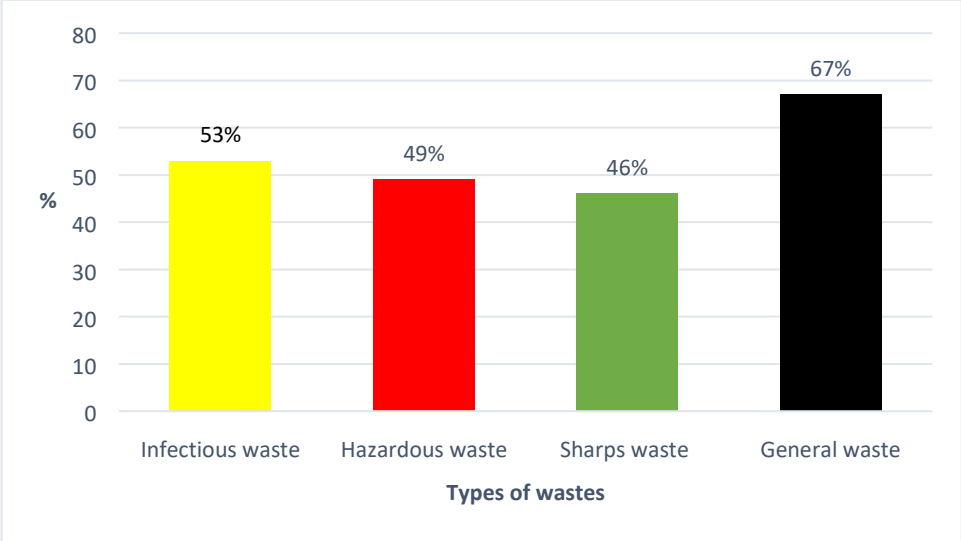

Figure 4.1: Categories of Medical Waste Generated

4.2.2 Generated Medical Waste as per Department

The analysis showed that, Accident and Emergency department produces more infectious wastes (34%), Sharps (34%) and general wastes (25%). Orthopedic department produces more sharps (29.7%), infectious wastes (28.7%), 23.8% general waste and 17.8% hazardous waste. General surgery produces more sharps and infectious wastes (36.3%), 22.5% general waste and 5% hazardous wastes. Reproductive health department produces more infectious wastes, (33.6%), 30.8% sharps, 29.5% genera wastes and 6.2% hazardous wastes. Pediatric department produces infectious, sharps and general waste in almost equal measure (30.7%) with 7.9% hazardous waste. The Laboratory department produces Infectious wastes 26.2%, general wastes (25.1%), hazardous waste and sharps at (24%) as shown in table 4.4.

Table 4.2: Generated Medical Waste as Per Department

Department	Waste generation categories			
	Infectious	**Hazardous**	**Sharps**	**General wastes**
Accident and Emergency	49 (34%)	10((6.9%)	49(34%)	36((25%)
Orthopaedic	29 (28.7%)	18(17.8%)	30(29.7%)	24(23.8%)
General Surgery	29(36.3%)	4(5%)	29(36.3%)	18(22.5%)
Reproductive health	49(33.6%)	9(6.2%)	45(30.8%)	43(29.5%)
Paediatrics	35(30.7%)	9(7.9%)	35(30.7%)	35(30.7%)
Incinerator	0	0	0	4(100%)
Laboratory	48(26.2%)	44(24%)	45(24.6%)	46(25.1%)

4.2.3 Factors to Non-Compliance to Segregation of Medical Wastes among the Respondents

The study sought to determine factors associated to non-compliance in segregation of different types of wastes. The majority of the respondents 72 %(103) used the yellow right color code to drop infectious waste, 72%(95) used red color-code to drop hazardous waste, 93% (115) used safety box to drop sharps and 73%(132) used black color code to drop general waste as shown in table 4.5.

Table 4.3: Use of Color Coding In Segregation

Type of Waste	Correct Color Code Used	Frequency (n)	Percentage (%)
Infectious Waste	Yellow	103	72%
Hazardous Waste	Red	95	72%
Sharps	Safety Box	115	93%
General Waste	Black	132	73%

Majority, 67.3% of the respondents referred to right color codes when segregating wastes all the time, while only 32.7% never used color codes when segregating different types of wastes.

4.2.4 Factors for Non-Compliance to Use of Color Codes during Segregation of Medical Waste among Respondents

The respondents who did not use color codes during segregating medical wastes showed that 76 % (179) never used the recommended color-coded bag since they were inadequacy while 21 %(73) were not provided for use while 3 %(20) were out of stock as shown in figure 4.5

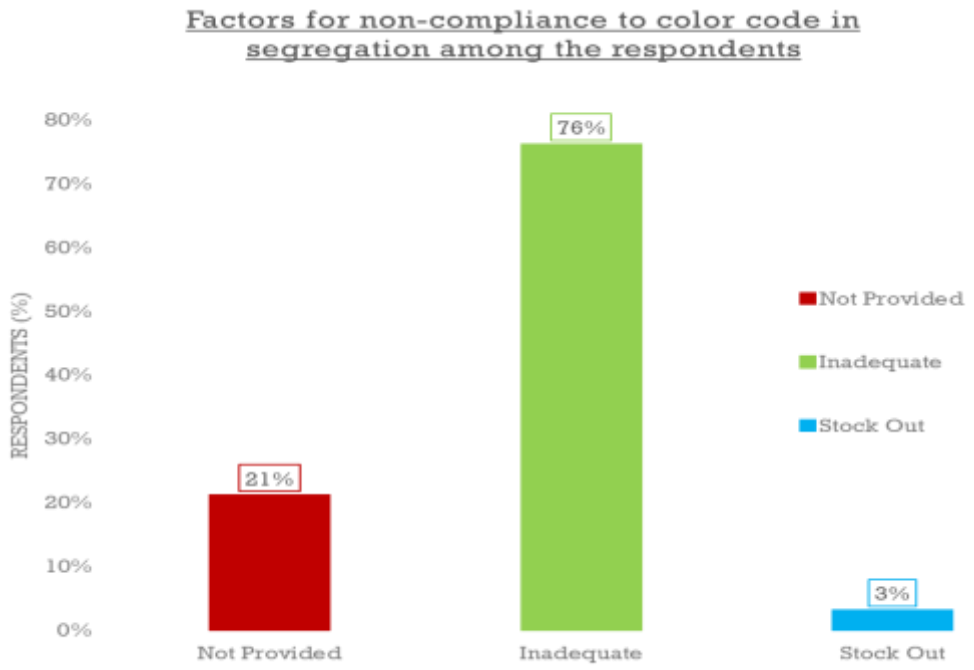

Figure 4.2: Factors for Non-Compliance to Color Code in Segregation among the Respondents

4.2.5 Collection and to Empty Medical Waste among the Respondents

Most, 89.0% (242) of the study respondents indicated they had a routine schedule for collecting waste from generation points with only 11.0% (30) asserting they were not aware of any routine schedule While 95.0% (230) stated that they collect waste every day and 5.0% (12) agreed they collect after one day.Majority 85.0% (231) of the respondents collected the waste containers when three-quarter full while14.3% (39) collected when the waste containers were over three-quarters full as shown in table 4.6.

Table 4.4: Collection of Medical Waste among the Respondents

Collection	Frequency (%n)	Percentage (%)
Routine schedule for the collection of medical waste		
Yes	30	11.0
No	242	89.0
Frequency of waste collection		
1 day	230	95.0
More than 1 day	12	5.0
Level to collect medical waste containers in the service areas		
3/4 full	231	85.0
Over 3/4	39	14.3

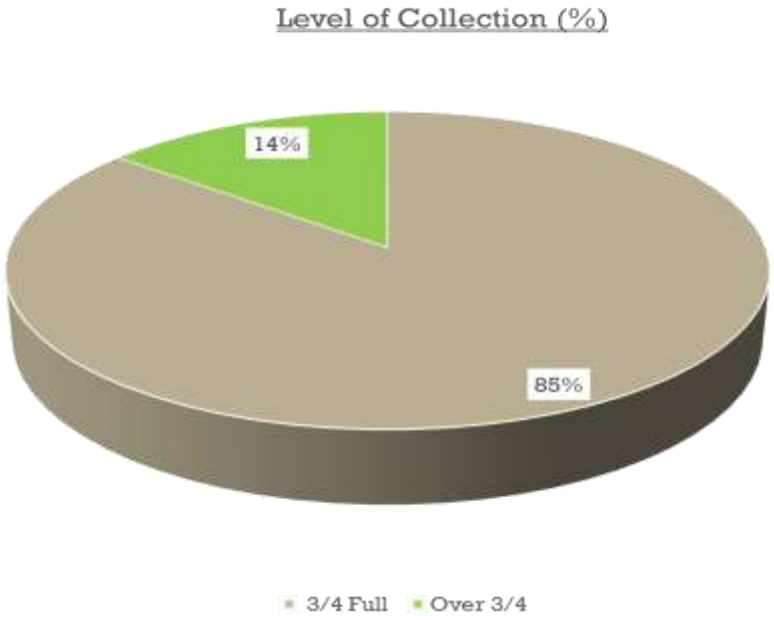

Figure 4.3: Collection Levels of Medical Waste Containers

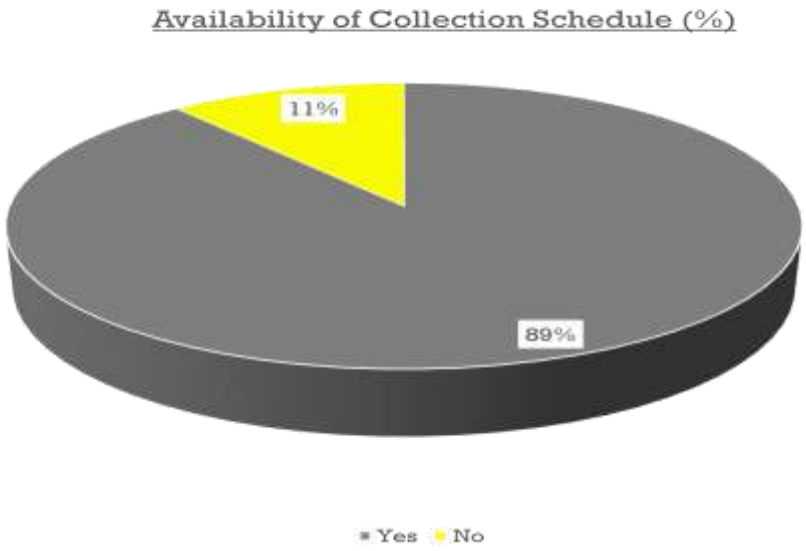

Figure 4.4: Availability of Collection Schedules

4.2.6 Factors Associated to Non-Compliance in Treatment Methods of Medical Waste among the Respondents

The most used method was incinerator 76% (205) while 24% (67) used other methods. Majority of the respondents 95%(258) highlighted the operational condition of the treatment method was in poor working condition while only 5% (14) pointed it to be in good working condition as represented in table 4.7.

Table 4.5: Treatment of Medical Waste among the Respondents

Methods of treatment	**n=272**	**%**
Incinerator	205	75.4
Open burning	0	0
Microwave	67	24.6
Autoclave	0	0
Landfill	0	0
Others	0	0
The operational condition of the method		
In good working conditions	14	5
In poor working conditions	258	95

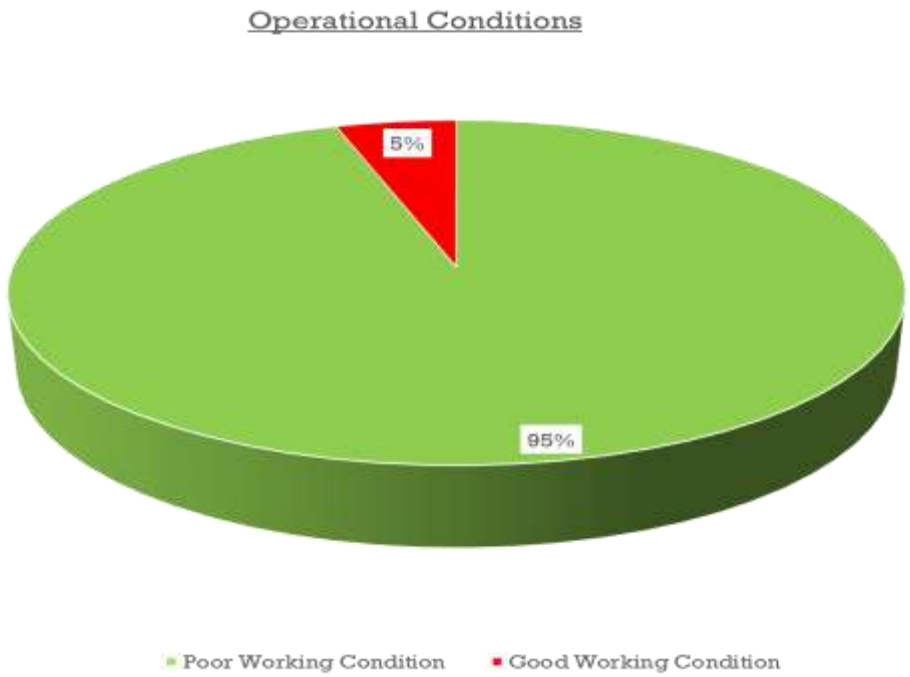

Figure 4.5: Method's Operational Conditions

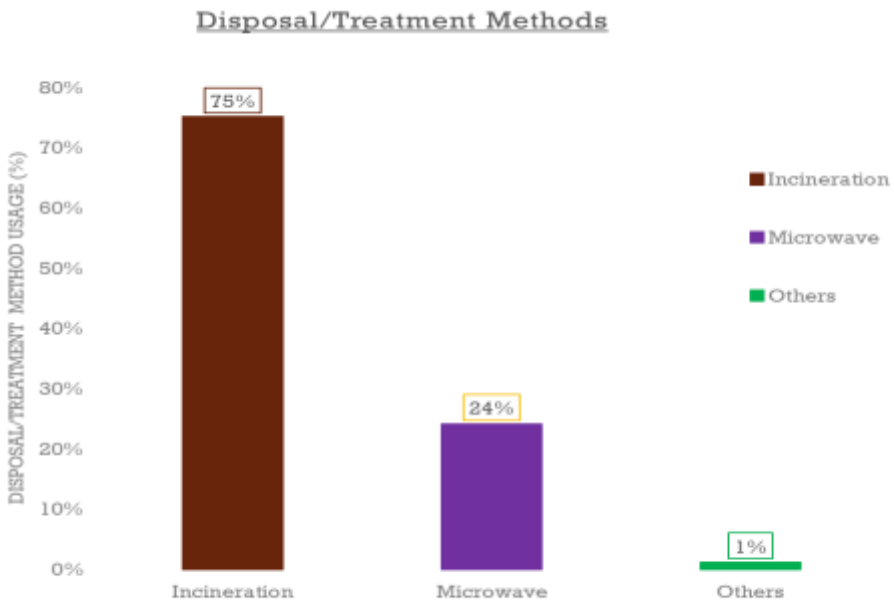

Figure 4.6: Treatment Methods Used.

4.3 Factors Associated to Non-Compliance to Safety Measures while Handling Medical Waste among the Respondents

4.3.1 Vaccination against Hepatitis B Infection among the Respondents

Majority, 60 %(163) highlighted to have not been vaccinated against HBV, where only 40%(109) of the respondents were vaccinated. The analysis also showed that 36% (59) of those who had not been vaccinated feared the side effects of the vaccine, 34%(56) did not know where to seek the services , 22% (35) feared the cost implications while a few of the respondents 8% (13) were too busy to seek the safety services as identified in table 4.8.

Table 4.6: Vaccination against Hepatitis B Infection among the Respondents

Safety	**n= 272**	**%**
Vaccinated against Hepatitis B infection		
Yes	109	40
No	163	60
Failure for vaccination	**n =163**	**%**
Did not know where to seek for the services	56	34
Feared the cost implication	35	22
Too busy to go for it	13	8
Feared the side effects	59	36

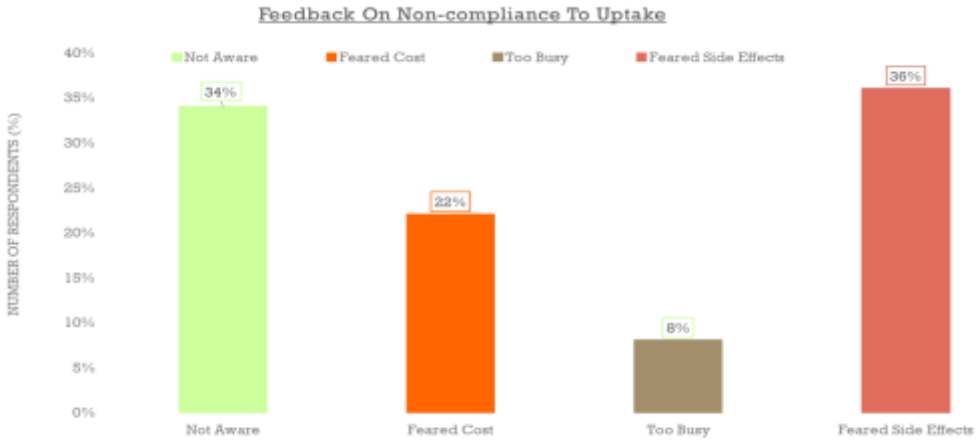

Figure 4.7: Feedback on Failure to Vaccinate among the Respondents

4.3.2 Treatment for Post Exposure Prophylaxis among the Respondents

Slightly more than half of the respondents 53%(145) indicated they had experienced an injury during handling of medical waste while 47% (127) had not, with further outcome revealing 57%(83) had needle prick injury followed by 34%(49) of the respondents experiencing cuts while the least 7%(10) and 2%(3) of the respondents experiencing bruises and others identified splashes respectively. The analysis further indicated that only 22 %(32) of the respondents Sought for PEP treatment, while higher 78 %(113) did not as shown in table 4.9

Table 4.7: Treatment for Post Exposure Prophylaxis among the Respondents.

Experiencing an injury while handling medical waste	**n =272**	**%**
Yes	145	53
No	127	47
Type of injury experienced while handling medical waste	**n=145**	**%**
Needle prick injury	83	57
Cut	49	34
Bruises	10	7
Others	3	2
Sought for PEP treatment	**n=145**	%
Yes	32	22
No	113	78

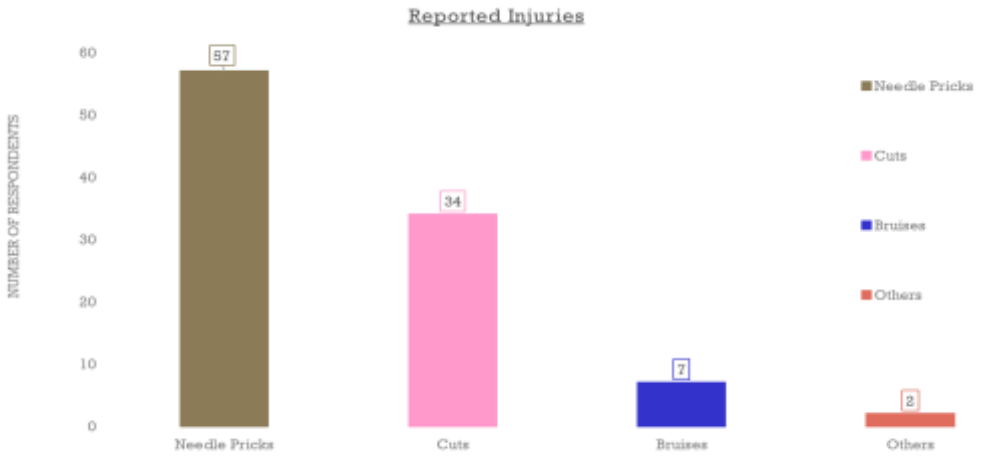

Figure 4.8: Injuries while Handling Waste among the Respondents

4.3.3 Noncompliance to Use of Personal Protective Equipment among the Respondents

A higher number of the study respondents 89% (241) indicated they are provided with PPE of which 84% (202) noted to use them when handling medical waste while the 16% (39) who don't use 64% (25) indicated the PPE were uncomfortable,26% (10) had medical challenges, 8%(3) religion restriction and only 2%(1) believed that PPE never give protection (table 4.10).

Table 4.8: Factors for Non-Compliance in Use of Personal Protective Equipment among the Respondents

Provided with PPE	**n=272**	**%**
Yes	241	89
No	31	11
Use of PPE when handling medical waste	**n=241**	**%**
Yes	202	84
No	39	16
Reason for noncompliance in using the PPE when handling medical waste.	**n=39**	**%**
They are uncomfortable to wear them	25	64
Have a medical challenge	10	26
My religious stops me	3	8
They don't give protection	1	2

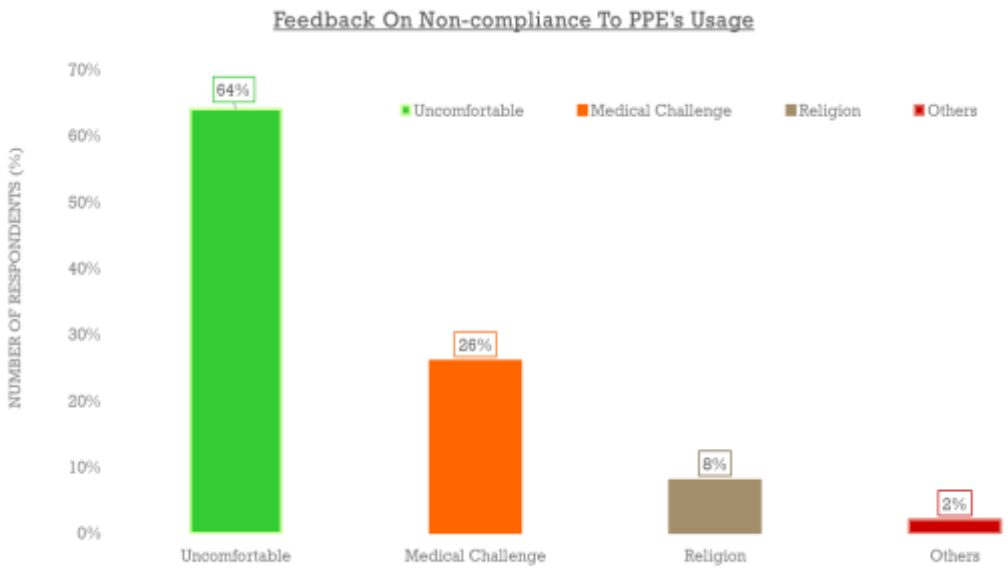

Figure 4.9: Feedback on Non-Compliance in Use of Personal Protective Equipment among the Respondents

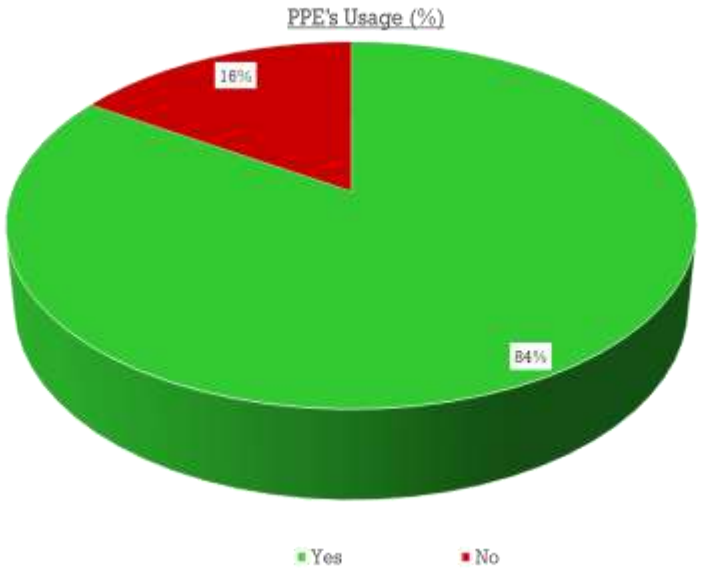

Figure 4.10: Feedback on PPE's Usage among the Respondents

4.4 Factors Associated with Non-Compliance in Medical Waste Practices among the Respondents

4.4.1 Factors Associated with Non-Compliance in Segregation Practices among the Respondents

The factors association with non compliance in segregation practices of medical waste was performed where the findings showed that there was statistically significant association between years of working and segregation of medical waste , $X^2(3) = 43.25$, $p = 0.000$, $p<0.05$.Health worker with 10- 15 years working experience were higher in noncompliance on segregation while those with 1 to 5years working experience were at a low in noncompliance while segregating medical waste as shown in table 4.11

Table 4.9: Factors Associated with Non-Compliance in Segregation Practices among the Respondents

		Non-compliance in segregation Medical waste.		**X^2**	**P-value**
		Correct code YES	Wrong code NO		
Job cadre	Doctor	11 (4.3%)	10(3.7%)	2.8	0.4
	Nurse	110 (40.4%)	35(12.8%)		
	Lab tech	28 (10.3%)	21(7.7%)		
	Support staff	33 (12.3%)	24(8.8%)		
Total		**182(67.3%)**	**90(32.7%)**		
Department	Accident and Emergency	31(11.3%)	15(5.5%)	5.828	0.56
	Lab tech	29(10.6%)	19(6.9%)		
	Reproductive health	34(12.5%)	13(4.7%)		
	Paediatrics	22(8.0%)	15(5.5%)		
	Orthopaedic	24(8.8%)	6(2.2%)		
	General Surgery	22(8,0%)	8(2.9%)		
	Medicine	17(6.2%)	9(3.3%)		
	Incinerator	3(1.1%)	5(1.8%)		
Total		**182(67.3%)**	**90(32.7%)**		
Years of working in hospital	**1 - 5 years**	**75(27.6%)**	**27(9.9%)**	43.25	0.000
	5 -10 years	49(17.6%)	22(8.0%)		
	10 -15 years	**49(18.0%)**	**39(14.3%)**		
	Above 15 years	10(3.6%)	2(0.7%)		
Total		**182(67.3%)**	**90(32.7%)**		

4.4.2 Factors Associated with Non-Compliance in Collection Schedule among Respondents

There was statistical significant association with noncompliance in collecting medical waste as per schedule among the health workers $X^2(6) = 5.828$, $p = 0.005$, $p<0.05$ with health workers from the department of reproductive health being at higher level of noncompliance with medical waste collection while those from laboratory were at a lower rate of non-complied in medical waste collection as shown in table 4.12.

Table 4.10: Factors Associated with Non-Compliance in Collection Schedule among Respondents

		Non-compliance in collection		X^2	P-value
		YES	NO		
Department	Accident and Emergency	41 (90%)	5(10%)	5.828	0.005
	Orthopaedic	27(90%)	3(10%)		
	General surgery	29(95.7%)	1(3.3%)		
	Reproductive health	**35(74.5%)**	**12(25.5%)**		
	Paediatrics	33(91.4%)	3 (8.6%)		
	Laboratory	**47(96.8%)**	**2 (4.0%)**		
	Medicine	24 (92%)	2(8%)		
Total		**236(89%)**	**28(11%)**		

4.4.3 Factors Associated with Non-Compliance in Safety Measures while Handling Medical Waste among Respondents

The findings showed that there was statistically significant association between non compliance in vaccination against Hepatitis B infection, $X^2(3) = 25.57$, $p = 0.000$, $p<0.05$,with the support staff being at higher in noncompliance while the laboratory technician were at a lower among health workers with noncompliance to HB vaccination as represented in table 4.13.

Table 4.11: Factors Associated with Non-Compliance in HB Vaccination among Respondents

		Non-compliance in safety measures-Vaccination against HBV		X^2	P-value
		YES	NO		
Health Workers	Doctors	5(23.8%)	16(76.2%)	25.57	0.000
	Lab Technician	**25(50%)**	**25(50%)**		
	Support Staff	**8(14%)**	**49(86%)**		
	Nurses	71(49.3%)	73(50.7%)		
Totals		**109(40%)**	**163(60%)**		

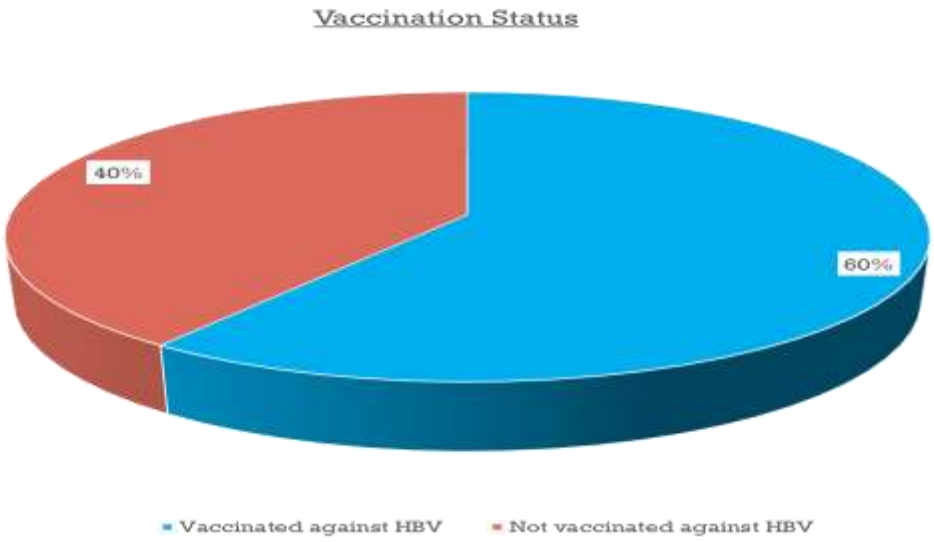

Figure 4.11: Vaccination Status among Respondents.

4.4.4 Factors Associated with Non-Compliance for Post Exposure Prophylaxis among Respondents

There was statistical significant association between noncompliance in seeking treatment for post exposure prophylaxis, $X^2(3) = 30.54$, $p = 0.001$, $p<0.05$, the nurses were at higher in noncompliance while the laboratory technicians were at lower from not seeking PEP treatment as represented in table 4.14.

Table 4.12: Factors Associated with Non- Compliance for Post Exposure Prophylaxis among Respondents

		Non-compliance in post Exposure prophylaxis		X^2	P-value
		YES	NO		
Health workers	Doctors	2(1.3%)	13(10.9%)	30.54	0.001
	Lab Technician	**15(10.3%)**	**6(8.3%)**		
	Support Staff	9(6.2%)	23((15.8%)		
	Nurses	**6(4.1%)**	**62(42.7%)**		
Total		**32(22%)**	**113(78%)**		

4.4.5 Factors Association with Non-Compliance for Personal Protective Equipment Use among Respondents

The results showed that there was statistical significant association between noncompliance in use of personnel protective equipment , $X^2(3) = 11.36$, $p = 0.001$, $p<0.05$ with nurses being at higher level of compliance in the use of PPE while support staff being at lower level by not using the PPE while handling medical waste as represented in table 4.15.

Table 4.13: Factors Association with Non-Compliance in Personal Protective Equipment among Respondents

		Non-compliance in use of PPE		X_2	P-value
		Comply YES	Not comply NO		
Health Workers	Doctors	14(77.8%)	4(22.3%)	11.36	0.001
	Lab Technician	37(77.1%)	11(22.9%)		
	Support Staff	**29(76.3%)**	**9(23.7%)**		
	Nurses	**122(89.1%)**	**15(10.9%)**		
Totals		**202(84%)**	**39(16%)**		

4.5 Relationship between Independent Variables and Dependent Variable

The study also aimed to investigate the relationship between the independent variables and how they were related to the dependent variable. Spearman's correlation was used

to test the relationship between the variables. Relationship between each independent variable was tested against the dependent variable. The results are detailed below

4.5.1 Relationship between Segregation and Compliance

Table 4.14: Relationship between Segregation and Compliance

		Compliance	Segregation
Compliance	Pearson Correlation	1	.543**
	Sig. (2-tailed)		.000
	N	272	272
Segregation	Pearson Correlation	.543**	1
	Sig. (2-tailed)	.000	
	N	272	272

**. Correlation is significant at the 0.01 level (2-tailed).

The Spearman's correlation coefficient was 0.543. This means that proper segregation will affect compliance at the rate of 0.543. The correlation coefficient was significant because the significance value was less than 0.01. This shows that proper segregation of medical waste improves compliance by a rate of 54.3%. This is in line with a study conducted by Syed et al. (2021) which found out that segregation at the point of waste generation significantly improved compliance with healthcare waste management protocols.

4.5.2 Relationship between Collection and Compliance

Table 4.15: Relationship between Collection and Compliance

		Compliance	Collection
Compliance	Pearson Correlation	1	.606**
	Sig. (2-tailed)		.000
	N	272	272
Collection	Pearson Correlation	.606**	1
	Sig. (2-tailed)	.000	
	N	272	272

**. Correlation is significant at the 0.01 level (2-tailed).

The Spearman's correlation coefficient was 0.606. This means that collection will affect compliance at the rate of 0.606. The correlation coefficient was significant because the significance value was less than 0.01. This shows that proper collection

processes will impact compliance of medical waste 60.6%. Das et al. (2021) conducted a study and found out that timely collection of waste was associated with higher compliance. This study results are in line with the findings of this research.

4.5.3 Relationship between Safety Measures and Compliance

Table 4.16: Relationship between Safety Measures and Compliance

		Compliance	SafetyMeasures
Compliance	Pearson Correlation	1	.519**
	Sig. (2-tailed)		.000
	N	272	272
SafetyMeasures	Pearson Correlation	.519**	1
	Sig. (2-tailed)	.000	
	N	272	272

**. Correlation is significant at the 0.01 level (2-tailed).

Results indicated the coefficient was 0.519.This showed a moderate positive relationship ($r = 0.519$, $p < 0.01$), meaning that provision and use of safety measures such as PPEs are linked with improved compliance. A study conducted by Mohamed et al. (2019) found out that the use of personal protective equipment (PPE) was significantly associated with higher compliance and lower injury rates.

4.5.4 Relationship between Treatment and Compliance

Table 4.17: Relationship between Treatment and Compliance

		Compliance	Treatment
Compliance	Pearson Correlation	1	.299**
	Sig. (2-tailed)		.001
	N	272	272
Treatment	Pearson Correlation	.299**	1
	Sig. (2-tailed)	.001	
	N	272	272

**. Correlation is significant at the 0.01 level (2-tailed).

Results showed that the coefficient value was 0.299. This shows a weak but significant correlation ($r = 0.299$, $p < 0.05$), suggesting that while waste treatment methods contribute to compliance, the impact is less pronounced. A research done by Hassan et al. (2018) found out that though treatment facilities like incinerators are important,

their operational condition was less significant in predicting compliance compared to segregation and PPE use.

4.5.5 Relationship between Generation and Compliance

Table 4.18: Relationship between Generation and Compliance

		Compliance	Generation
Compliance	Pearson Correlation	1	.102
	Sig. (2-tailed)		.008
	N	272	272
Generation	Pearson Correlation	.102	1
	Sig. (2-tailed)	.008	
	N	272	272

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficient was 0.102. This shows a very weak and non-significant correlation ($r = 0.102$, $p > 0.05$), implying that the type or amount of waste generated does not significantly affect compliance on its own. In agreement to the findings of this research a study conducted by Tudor et al. (2012) found out that the quantity or category of medical waste generated did not significantly affect compliance unless accompanied by training and monitoring.

4.5.6 Binary Logistic Regression

Lastly the study aimed to investigate the overall impact of the independent variables on the dependent one. A binary logistic Regression model was used and the results are detailed in the table below.

Table 4.19: Binary Logistic Regression Model

Variable	Sig.	Logistic β	p-value	Exp(B)
Generation	0.421	0.276	0.421	1.32
Segregation	0.005	1.876	0.005	6.53
Collection	0.014	1.459	0.014	4.30
Treatment	0.109	0.782	0.109	2.19
Safety Measures	0.042	1.127	0.042	3.08

The binary logistic regression model assessed the predictive power of the independent variables on the likelihood of compliance (yes/no). Results indicated that Segregation

was a statistically significant predictor (β = 1.876, p = 0.005). This means that respondents who practiced proper segregation were nearly 6.5 times more likely to be compliant with medical waste regulations (Exp(B) = 6.53). Collection also significantly predicted compliance (β = 1.459, p = 0.014), with Exp(B) of 4.30, meaning regular waste collection increased the odds of compliance by over four times. Safety Measures showed significant impact as well (β = 1.127, p = 0.042), increasing the odds of compliance by 3.08 times. Treatment did not significantly predict compliance (β = 0.782, p = 0.109), suggesting its limited effect in determining whether a facility is compliant or not. Generation had no significant influence on compliance (β = 0.276, p = **0.**421), confirming the correlation result.

The model's Nagelkerke R^2 = 0.432**,** indicating that about 43.2**%** of the variation in compliance could be explained by the five predictors.This showed a good value in prediction of compliance of medical waste by the five independent variables. Medical facilities should emphasize more on the factors that influence this compliance which would prevent workers from less injuries and as well as promote safe working environments and a safer environment.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECCOMMENDATION

5.1 Socio Demographic Characteristic among the Respondents

The demographic data includes sex, job cadre, department where the respondents work and period worked at the hospital in years.

The results showed that (51%) were female and (53%) of the respondents were nurses.Highest (38%) of the respondents had a work experience of 5 to 10 years with (4%) having worked over 15 years, with associations on noncompliance in medical waste practices ($X^2(3) = 43.25, p = 0.000, p<0.05$).highlighting the health workers with 1-5 years working experience were at a lower exposure while those with 10 -15 years being at higher exposure from the medical waste related incidents such as Hepatitis A, B and C, HIV/AIDS, and needle prick injuries.

Basing on the findings health workers with 1-5 years working experience with lower levels of non compliance in medical waste practices which attributed to being new in the service inducted and tending to follow the available structures and processes with fear of not being confirmed in the service unlike with those having longer working experience having an attitude.

The findings concurred with (MOH,2012) an assessment conducted in 111 government and non-government health facilities across the country where half of the respondents in the facilities were nurses (51%), followed closely with support staff (22%) and the least (13%) doctors. In contrary to the current study (Haifete, 2016). The study conducted in Namibia assessing on medical waste among health care workers highlighted majority of the respondents (23%) had worked in the health facility between 1-5 years and those who had worked above 10 years were (60%) an indication that majority of the health workers were lower in noncompliance in medical waste practices

5.1.1 Handling Practices on Medical Waste among Respondents

The handling practices includes generation, segregation collection and treatment of medical waste, the highest generated medical waste is (67%) general waste followed closely with (53%) infectious, hazardous waste at (49%).The findings concurred with (WHO, 2012) stating the (80%) of the generated waste is general, infectious (15%) and (5%) sharps.In contrast a study conducted in Bangladesh among medical waste generated were infectious (14%) being highest followed by plastic waste(5%) and sharps (1.2%) (Ali *et al,* 2015). The emphasis attributed in sensitization to ensure health workers complies with various categories of medical waste generated as per available policy and guidelines.

Segregation of medical waste is a critical practice in medical waste management since noncompliance in segregation can lead to risks of contracting infections related to medical waste management such as Hepatitis B,C, HIV/ AIDS,and physical injuries. Compliance in segregation leads to income generation through reuse and recycling of non-contaminated medical waste, it also reduces the cost of treatment/ disposal of medical waste (GOK 2010). The current study reviewed that both infectious waste and hazardous waste were segregated at (72%) each, (93%) sharps while general waste was segregated at (73%). Any non-segregated general waste automatically is categorized as infectious waste in line with (MOH 2015).

Contrary to the current study, a study conducted in South Africa revealed that 48% of hazardous waste was segregated leading to 52% unsegregated waste (Hangulu, 2017), with slight improvement in segregation is an indication that health workers through training's have seen the importance in compliance in segregation. An association was identified between risks and compliance in segregation in relation to the years one worked in the hospital, Health worker with 10 to 15 years working experience 14.3% were at high risk from the effects associated with medical waste due to noncompliance in segregation but those with 5 to 10 years working experience were at a low risk 27.6% from the same effects of segregation which include, needle prick injuries, Hepatitis B infections associated with the patient’s body fluids like contaminated blood, urine, vomits and cuts among the health workers.

The results concurred with study by (Njiru, 2015) which had a significant in risks being associated with segregation of medical waste with $p<0.05$ in relation to the number of years one worked.

Reasons highlighted by the respondents as to why they were not using the right color code all the time (76%) indicated they were inadequate, (21%) were not provided while (3%) indicated they were not accessible. The findings are contrary to (Pruss *et al*, 2014) where hospitals management are required to provide adequate liner bags and strong plastic containers for segregation at all times and easily accessible to both generators and handlers.The outcome can be attributed to lower budgetary allocation towards waste management leading to stock outs.

Having a routine schedule in collecting medical waste from service area a higher rate (89.6%) of the respondents indicated they have and those who empty the containers in the recommended ¾ full were (85.6%) and collection of medical waste on daily basis was rated high at (97.9%) with risks associated with compliance in collection of medical waste from departments $(X^2(6) = 5.828, p = 0.005, p<0.05)$ where Laboratory department being at a lower risk and reproductive health associated with a higher risks among health workers, with compliance it reduces the risks of HAI's ,environmental pollution such as odors vector vermin breeding from the uncollected decomposing medical waste at the generation points.

The results concurred with observation made by (Njiru, 2015) where 99% of the health workers at hospitals in Nairobi county, Kenya reported that they collected medical waste on a daily basis which also concurs with the (MOH, 2016)

The highly waste treatment method used was incinerator at (92%) followed by microwave (8%) with (95%) of the respondents indicating the method chosen was in poor operation condition The findings concurred with (MOH, 2016) health care waste management plan, where most hospitals in Kenya treat their waste on site among (15%) of hospitals have approved waste treatment equipment. Incineration in level four and five health facilities is the commonest method of waste treatment at (62%) using a functional incinerator , the rest were either dysfunctional or undergoing repairs , the shredders are found in few hospitals which are mainly high level private hospitals

namely Aga Khan, Nairobi and Mater hospitals. Most of the hospitals in Kenya have no alternative waste treatment option apart from incineration.

Inappropriate treatment of medical waste leading to environmental pollution and endangers lives of the exposed populations. For instance open burning of medical waste leads to release incombustible smoke and dangerous emissions causing air pollution that exposes people and animals to detrimental health risks. Disposal of medical waste in landfills can results in leaching leading to underground water pollution, incinerators are common used technology in treatment of medical waste in the third world countries (Pruss et al, 2014).

5.1.2 Safety Measures While Handling Medical Waste among Respondents

Each health care facility is responsible for providing a safe, healthy work place and safe systems of work for all. World Health Organization estimates that about 21 million health workers globally are at risk of Hepatitis B infectious associated with medical waste (Ola-Adisa,Mangden,Sati$Adisa,2015).

The current study indicated that only 40% (109) of the respondents were vaccinated against Hepatitis B infection while a higher 60% (163) were not, with 36% (59) pointing out that they feared the side effects, 34% (56) didn't know where to seek services, 22% (35) feared cost implications further 8% (13) were too busy to seek for services with a significant association between risks and compliance in vaccination against HB infection among the cadre ($X^2(3) = 25.57$, $p = 0.000$, $p<0.05$). with Laboratory technologists being at a lower risk of contracting Hepatitis B infection compared to support staff who were at a higher risk due to non-compliance

A similar scenario was observed in Khartoum Sudan in health facilities where 60.6% of health workers were not vaccinated against HB indicating that it was not provided by the hospital (Ahmed et al., 2015) Contrary to the current study a larger number of health workers 84% working at Mama Lucy, Mbagathi and Mathare Nairobi county hospitals were vaccinated against HB infection(Wafula, 2012).The hospital has not developed strong policies regarding vaccination of health workers which present gaps

or the emphasis to educate the health workers on the health impact the Hepatitis disease has visa vie the free vaccination provided in the hospital for its workers.

Reporting of incidents, accidents or near misses that may be associated with health care waste is important for the investigator in follow-up to identify the risk points and put up mitigation measures further measures and emphasis to follow when taking details from the affected person to avoid gaps while making decisions (CDC, 2013). It is recommended that once an individual is injured and the injury is associated with needle prick, cuts while handling medical waste to seek medical attention within 72 hours to get post exposure prophylaxis against HIV AIDS (GOK, 2011).

The current study indicates 53%(145) of the respondents had an injury while handling medical waste of which 57% (83) having been pricked by used needle and shocking revelation where only 22% (32) sort for PEP treatment,a statistical significant between compliance and non compliance in seeking for PEP treatment among the cadres ($X^2(3) = 30.54$, $p = 0.001$, $p<0.05$),where Lab technologists being at the lower risks of contracting HIV /AIDS from their compliance in seeking PEP treatment after experiencing an injury while handling medical waste unlike the nurses who are at a higher risks from contracting the infection by non compliance.

The findings is in contrast with the study conducted in Nigeria on occupational injury from medical sharps indicted that higher 63.5% of the health workers who experienced needle stick injuries sort for PEP treatment (Olanrewaju, 2019) with low compliance in PEP treatment is an indication that the health workers have not internalized the impact associated with the contaminated needle prick.

The literature source advocate for importance of all medical waste to be tagged with a unique reference number which is traceable to the point of production, in case of incident this will allow each package to be traced to the actual generator (GOK 2010). In the current study majority 62% (40) of the respondents noted the collected waste had tagging stickers on the liner bags while only 38% (25) were not able to identify the tag/sticker on the liner bags,98%(39) of the respondents agreed that the tagging sticker was fully filled to trace the origin of the medical waste away from the generation point, a contrary outcome was noted in a study conducted in Akure Nigeria

on medical waste management in 7 hospital where 94% (120) of the respondents had not used or seen the tagging on medical waste bags(Olufursho *et a*l,2016). Contrary to a study conducted by (MOH and USAID under the PACE project in 2012) reveled that 88.7% (80) had not labeled/tagged the generated waste only 12.3% (20) facilities had complied posing serious challenges in tracing the medical waste to help in taking corrective measures.

The personal protective equipment are aimed to protect the user against health or safety risks at work, which include items such as safety helmets, gloves, eye protection high visibility, clothing, safety footwear and respiratory protective equipment, the employers have duties concerning the provision and use of PPE at work for free (GOK,2010). Health workers have information on the need to protect themselves from risks through use of protective gear.

The current study revealed that 89% (241) of the respondents are provided with PPE where 84% (202) use the PPE while handling medical waste while 16% (39) who never used pointed out that the PPE were uncomfortable, having medical challenges, religious restrictions and not provided by the hospital with statistical significant association between risks and compliance in use of the PPE among the carders ($X^2(3) = 11.36$, $p = 0.001$, $p<0.05$),nurses were at a lower risk from medical waste related activities while the support staff were at a higher risks due to non compliance from the use of PPE The findings being in agreement with (Wafula,2012) where 98% of health workers at health centers in Nairobi county used gloves and 95% used masks, however only 40% wear an apron and 30% use laboratory coats, in contrary 90% of the health workers in Offinso Municipality, Ghana did not use gloves as protective wear during medical waste handling no other protective wear was used (Yawson,2015), these can be a reflection of no policy in place or having a negative attitude in the implementation of the policy. In Gondar town, Northwest Ethiopia, the majority of the health workers 93.1% use gloves during medical waste handling (Muluken *et al.,* 2014). Due to infections, injuries and foul smell arising from medical waste; it is necessary for health workers to wear personal protective equipment and gears (Yawson, 2015).

5.2 Conclusion

5.2.1 Socio- Demographic Characteristics.

A higher compliance and lower factors associated with noncompliance while handling medical waste was demonstrated among health workers with less than 5 years working experience compared to those with more than 5 years working experience.

5.2.2 Handling Practices of Medical Waste

The collection of generated medical waste from the departments was a challenge exposing the health workers to risks while handling medical waste.

The poor operational status of the medical waste treatment plants which has led to the backlog of medical waste exposing risks to health workers handling medical waste.

5.2.3 Safety Measures while Handling Medical Waste

The PPE were adequately provided among health workers handling medical waste with challenges of being uncomfortable while using them with doctors being at higher risk of handling medical waste without using the PPE.

Injuries were experienced among health workers while handling medical waste with insignificant numbers seeking for PEP treatment which exposes them to higher risks of contracting HIV/AIDS.

Lower vaccination coverage rate on Hepatitis B infection among health workers handling medical waste poses them to a higher risk of contracting the infection.

5.3 Recommendations

5.3.1 Socio- Demographic

Regular sensitization among health workers on total compliance while handling medical waste.

5.3.2 Handling Practices

Develop and comply with plant preventive maintenance schedule of all treatment plants to improve the operational status.

5.3.3 Safety Measures

Train all health workers the importance of Post exposure prophylaxis treatment and vaccination compliance against Hepatitis B infection in the hospital.

The study was able to highlight many positives on medical waste while there is need to further carry out study on possible treatment methods. It also faced with limitations which included, insufficient and unreliable data, methodology that restricted to health care workers, time budget constraints and self-reported information which leads to biases and lack of verification

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APPENDICES

Appendix I: Consent Document

Dear Respondent,

Please read and understand before signing the consent below.

Study title: Determine the management of medical waste practices among health workers at Kenyatta National Hospital Nairobi County.

Investigator,

My name is Gilbert OnyonkaObegi and I am a MSC student at Jomo Kenyatta University of Agriculture and Technology, I am conducting a study to determine the management of medical waste practices among health workers at Kenyatta National Hospital. Medical waste is one category of waste generated from health facility alongside radioactive waste and dead bodies, also known as infectious waste, biomedical waste with the following categories; Clinical, Anatomical (human tissues), sharps, Chemicals (reagents), Pharmaceutical, General (papers) and Food remains, which forms 10%-25% of waste generated.

Please feel free to ask questions as we go along. Before you decide whether to join or not, please remember that the decision to join the study is voluntary. If you decide not to join the study, you will not lose any benefits. If after joining the study you change your mind about taking part in the study, I will ask you to sign a form indicating withdrawal from the study so that the information gathered from you may not be used without your permission.

Study Procedure

If you met the set inclusion criteria of the study and sign this consent form you will be given a self-administered questionnaire which has sections **A** –To collect the demographic characteristics of the respondent such as gender, profession, department, ward, duration of working in years, **B-** will be used to collect data on medical waste

handling practices. **C-** will be used to collect data on compliance on safety measures while handling medical waste

During the study, all information will be kept private and confidential by the principal investigator.

Benefits

You will not benefit from this study other than being careful and observant when giving information and may you want more information you can contact the signed below. Your participation in this study may result in better management practice when handling medical waste. It will not cost you anything to be part of this study. You will also not receive any money for taking part in this study.

Risks

There is a small risk of a breach in confidentiality should the information collected be necessary for the process of medical waste handling practices and may end up being shared with other Health workers. However, no bodily harm will happen to you when taking part in this study.

Confidentiality

We will maintain confidentiality, initials and coded numbers will be used to identify the participants, source documents, study reports. All study records will be maintained in a secured location. Participants will be assured of confidentiality that their names will not appear in any report.

What if I have questions?

If you have further questions or concerns about taking part in this study, please call the principal investigator at this **no 0722856470.**

This project has been approved by the KNH/UoN Ethical Review Committee. The committee ensures the protection of volunteers in research. If you have questions about your role as a participant in any study, please contact the secretary, KNH/UoN Ethics Review Committee, P.O.

BOX 20723 Code 00202 Tel. 725272-9 Email. Uonknh-erc@uonbi.ac.ke

Participants' statement of consent

I have had a chance to ask questions and the questions have been answered fully. I have fully understood the study. If I have further questions about the study, I am free to ask the investigators listed above. By signing this form I confirm that I have voluntarily chosen to take part in this study and that I can withdraw anytime without losing any health benefits

Participants Name/Thumbprint mark…… Signature……...

Date…….Contact……

Principal investigator…….....Signature……

Date……..

Appendix II: Questionnaire

SECTION A

Used to get information on social demographic characteristics among study respondents

Please indicate your answer with a tick (√) within the checkbox on the appropriate answer.

1. Gender
   - i.) Male ☐
   - ii.) Female ☐

2. What is your job cadre?
   - i.) Doctor ☐
   - ii.) Nurse ☐
   - iii.) Lab tech ☐
   - iv.) Support staff ☐
   - v.) Any other (specify) _____

3. Which department, unit, and ward do you work in?
   - i.) Accident and Emergency (Casualty) ☐
   - ii.) Orthopedic ☐
   - iii.) General Surgery ☐
   - iv.) Reproductive health ☐
   - v.) Paediatrics ☐
   - vi.) Incinerator ☐
   - vii.) Laboratory ☐
   - viii.) Any other (specify)_____

4. How long have you worked in this hospital? (years) _____

i) 1 - 5 years ☐

ii) 5 - 10 years ☐

iii) 10 - 15 years ☐

iv) Above 15 years ☐

SECTION B

To establish data on medical waste handling practices.

5. What type of wastes do you mainly generate in this department/unit/ward?

i.) Infectious waste (being in contact with patient blood and body fluids) ☐

ii.) Hazardous waste (chemicals, solvents, mercury in thermometers paints) ☐

iii.) Sharps waste (used needles, surgical blade) ☐

iv.) General papers (papers, plastics food remains) ☐

v.) Others (specify) _____

6. What color code do you put the wastes mentioned in (NO 5) above?

Waste category	Yellow	Black	Red	Safety box	Others
Infectious waste					
Hazardous waste					
Sharps waste					
General waste					
Others (specify)					

7. Why don't you use the color codes mentioned in (NO 6) above?

i.) Inadequate ☐

ii.) Not Accessible ☐

iii.) Don't understand ☐

iv.) Any other (Specify) _____

8. Do you have a routine schedule for collecting medical waste from generation point?

Yes ☐

No ☐

9. If your answer in (No 8) above is yes how often do you use it to collect waste?

After 1 day ☐

After 2 days ☐

Above 2 days ☐

10. At what level do you empty the waste containers in the service areas?

i.) ¾ full ☐

ii.) Above 3/4 full ☐

iii.) Others (Specify)_____

To assess the current treatment practices

11. Which method is used to treat medical waste in the hospital?

i.) Incinerator ☐

ii.) Open burning ☐

iii.) Microwave ☐

iv.) Autoclave ☐

v.) Landfill ☐

vi.) Any other (specify) _____

12. How is the operational condition of the method chosen in (NO 13) above?

i.) Good working condition (It is able to clear daily yield of waste) ☐

ii.) Poor working condition (Having frequent break downs) ☐

iii.) Any other (specify)……..

SECTION C

To determine safety measures while handling medical waste.

13. Have you been vaccinated against Hepatitis B infection?

i.) Yes ☐

ii.) No ☐

14. If the answer to question (NO 13) above is No, why have you not been vaccinated?

i) Did not know where to get the services ☐

ii) Feared the cost implications ☐

iii) Feared the side effects ☐

☐

iv) Too busy to go for it

15. Have you ever experienced an injury while handling medical waste?

Yes ☐

No ☐

16. If your answer to question (No 15) above is Yes what kind of injury?

i). Needle prick injury ☐

iii). Cut ☐

iv.) Bruises ☐

v). Any other (Specify)……

17. After experiencing an injury mentioned in (NO 16) did you sought for Post exposure prophylaxis treatment?

i) Yes ☐

ii) No ☐

18. Does the collected medical waste have a tracking sticker/tag giving details from where waste was generated?

i) Yes ☐

ii) No ☐

19. If your answer to question (NO18) above is No why were they lacking the stickers?

i) The stickers/tags were out of stock ☐

ii) Do not understand them ☐

iii) Any other (Specify)……..

20. Are you provided with personal protective equipment in the hospital? **TO BE ANSWERD BY ALL STUDY RESPONDENTS**

i) Yes ☐

ii) No ☐

21. If your answer to question (NO 20) above is Yes do you use them while handling medical waste?

i) Yes ☐

ii) No ☐

22. If your answer to question (NO21) above is No why are you not using them while handling medical waste?

i) They are too uncomfortable to use them ☐

ii) I have a medical challenge to use them ☐

iii) My religion stops me from using them ☐

iv) They don't provide any protection ☐

END THANK YOU

Appendix III: Letter of Acceptance

www.iprjb.org

Date: 06/01/2020

Dear Onyonka Obegi Gilbert,

Acceptance Letter

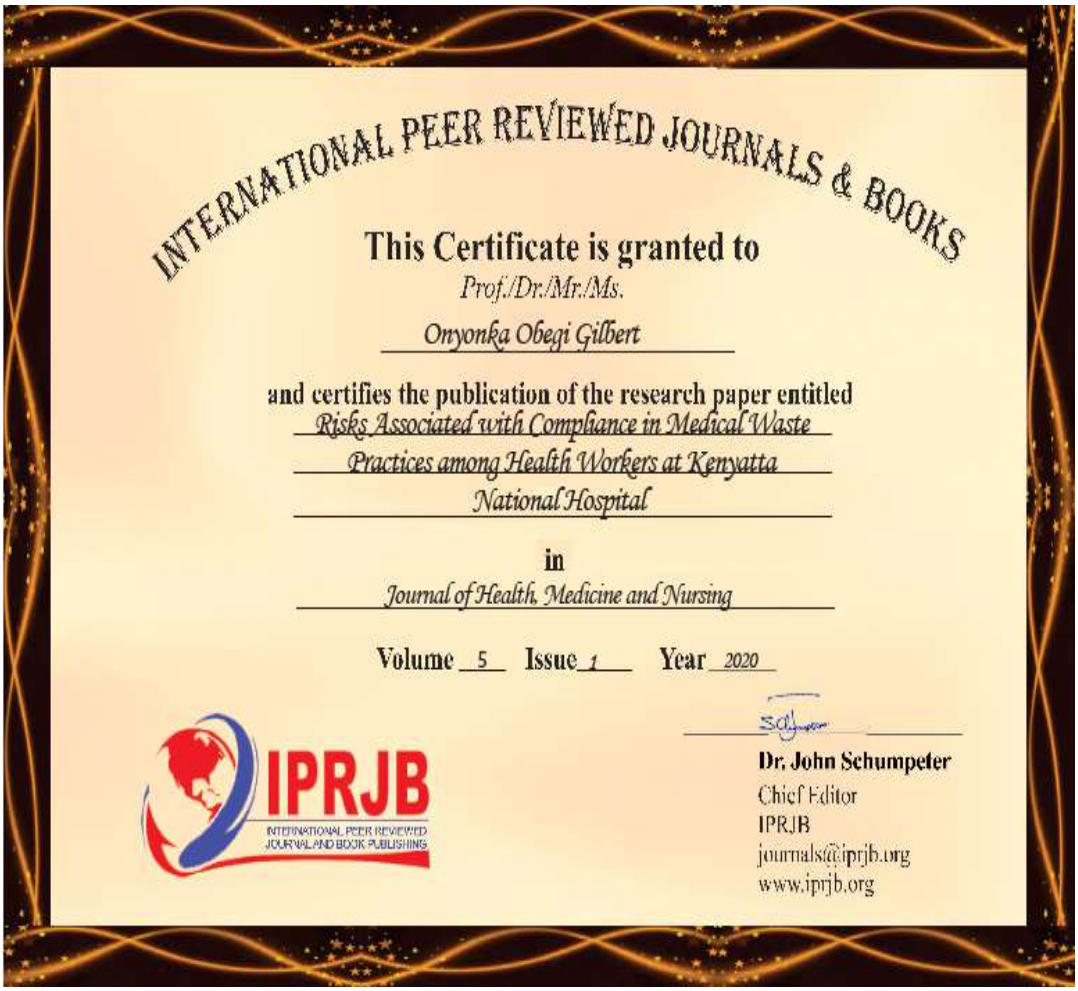
This is to formally inform you that your manuscript entitled **"RISKS ASSOCIATED WITH COMPLIANCE IN MEDICAL WASTE PRACTICES AMONG HEALTH WORKERS AT KENYATTA NATIONAL HOSPITAL"** has been accepted for publication in the **Journal of Health, Medicine and Nursing (JHMN).**

Thank you for sending your manuscript to us and we hope to receive more manuscripts from you and your colleagues.

Best Regards,

Dr. John Schumpeter
Chief Editor
IPRJB
journals@iprjb.org
www.iprjb.org

Appendix IV: Certificate of Publication



INTERNATIONAL PEER REVIEWED JOURNALS & BOOKS

This Certificate is granted to

Prof./Dr./Mr./Ms.

Onyonka Obegi Gilbert

and certifies the publication of the research paper entitled

Risks Associated with Compliance in Medical Waste Practices among Health Workers at Kenyatta National Hospital

in

Journal of Health, Medicine and Nursing

Volume 5 Issue 1 Year 2020

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Dr. John Schumpeter
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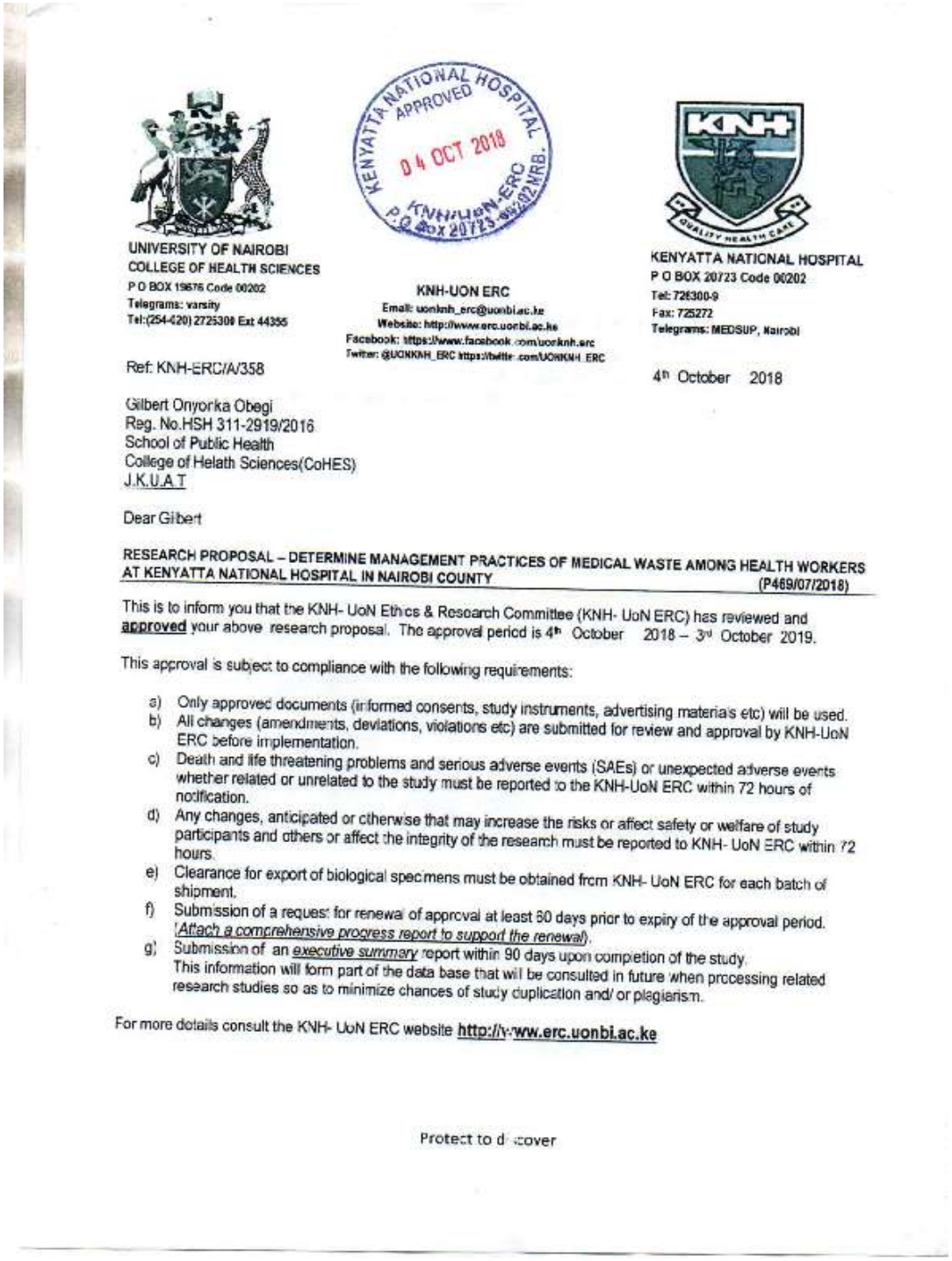
Appendix V: Letter of Approval from KNH-UoN Ethics



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KENYATTA NATIONAL HOSPITAL APPROVED 04 OCT 2018 KNH/UON-ERC P.O Box 20723-00202 NRB.

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Ref: KNH-ERC/A/358

4th October 2018

Gilbert Onyonka Obegi
Reg. No.HSH 311-2919/2016
School of Public Health
College of Helath Sciences(CoHES)
J.K.U.A.T

Dear Gilbert

RESEARCH PROPOSAL – DETERMINE MANAGEMENT PRACTICES OF MEDICAL WASTE AMONG HEALTH WORKERS AT KENYATTA NATIONAL HOSPITAL IN NAIROBI COUNTY (P469/07/2018)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 4th October 2018 – 3rd October 2019.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH-UoN ERC before implementation.
c) Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e) Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g) Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Protect to discover

Appendix VI: Authority to Conduct Study at KNH

KNH/R&P/FORM/01

KENYATTA NATIONAL HOSPITAL
P.O. Box 20723-00202 Nairobi

Tel.: 2726300/2726450/2726565
Research & Programs: Ext. 44705
Fax: 2725272
Email: knhresearch@gmail.com

Study Registration Certificate

1. Name of the Principal Investigator/Researcher
   GILBERT ONYONKA OBEGI
2. Email address: gilbert.obegi@gmail.com Tel No. 0722-856470
3. Contact person (If different from PI)... DR. DENNIS MAGU
4. Email address: magudennis@gmail.com Tel No. 0722574388
5. Study Title
   DETERMINE MANAGEMENT PRACTICES OF MEDICAL WASTE AMONG HEALTH WORKERS AT KENYATTA NATIONAL HOSPITAL IN NAIROBI COUNTY
6. Department where the study will be conducted ... PUBLIC HEALTH.
   (Please attach copy of Abstract)
7. Endorsed by Research Coordinator of the KNH Department where the study will be conducted.
   Name: Bernard K Kunyenje for Signature ... Date 11/10/2018
8. Endorsed by KNH Head of Department where study will be conducted.
   Name: B.K. Kunyenje Signature ... Date 11/10/2018
9. KNH UoN Ethics Research Committee approved study number P469/07/2018.
   (Please attach copy of ERC approval)
10. I GILBERT ONYONKA OBEGI commit to submit a report of my study findings to the Department where the study will be conducted and to the Department of Research and Programs.
    Signature ... Date 12/10/2018
11. Study Registration number (Dept/Number/Year) PH /7 /2018
    (To be completed by Research and Programs Department)
12. Research and Program Stamp

All studies conducted at Kenyatta National Hospital **must** be registered with the Department of Research and Programs and Investigators **must commit** to share results with the hospital.

Version 2: August, 2014