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# Infectious Waste Management in General Hospitals in Lusaka, Zambia: Perspectives of Healthcare Workers

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## Abstract

**Purpose:** Poorly managed infectious waste was the cause of majority of accidents and exposures to infectious waste in general hospitals in Zambia. The overall aim of this study was to appraise infectious waste management in the five general hospitals in Lusaka, Zambia.

**Methodology:** An explorative qualitative study was conducted to assess infectious waste management in Lusaka, Zambia, nesting the perspectives of 21 healthcare workers drawn from five general hospitals in Lusaka district.

**Findings:** The results showed that, the state of infectious waste management in a cross-section of general hospitals in Zambia had fallen short of the World Health recommended standards. A myriad of contributing factors to poor waste management amplified included, lack of regular staff training, insufficient infectious waste management equipment and inadequate protective clothing for waste handling, stock out of colour- coded bin liners and bins was a common occurrence. Other key findings were, limited space for storing waste before disposal or transportation and the lack of awareness about segregation and waste management rules as well as the limited financial resources to procure standard infectious waste protection and disposal equipment.

**Unique Contribution to Theory, Policy and Practice:** The study recommended to conduct longitudinal studies across hospitals to establish the impact of waste management practices and its corresponding health risks, the government to effectively fund hospitals to enable them train health workers, procure adequate infectious waste management equipment among others in case of delayed supplies from or central supply chain and to sub contract the private sector or social entrepreneurs to manage waste on behalf of hospitals to address the current challenges facing the general hospitals while seeking for sustainable long term solutions. Furthermore, ZEMA should increase its operational capacity to enhance effective monitoring of Health Care Institutions over Health Care Waste compliance and surveillances.

**Keywords:** *Infectious Waste, Knowledge, Attitude, Policy Compliance*

## 1.0 INTRODUCTION

Infectious Waste (IW) is waste contaminated with blood and other bodily fluids, cultures and stocks of infectious agents from laboratory waste, autopsies and infected animals from laboratories or waste from patients with infections (WHO 2018) as "all the waste generated within healthcare facilities, research centres, and laboratories. Waste management is all activities, administrative and operational, involved in the handling, treatment, storage, recovery and recycling (of healthcare general waste) and the disposal of waste (including transportation). Mainly the generators of infectious waste are healthcare workers in hospitals during provision of healthcare services such as screening, immunization, treatment of patients and research in hospitals (Makhuru et al., 2016; Khobragade, 2019; Das et al., 2021).

Mostly waste produced in hospitals comprises of infectious waste, which however, is not disposed of with domestic waste due to its infectious and hazardous character. Its management has been an imperative environmental and public safety issue and for this reason infectious waste management should be viewed seriously by all health care institutions in order to prevent infectious waste from becoming a source of health problems in the institution and exposing the community to infections (Dewi, 2020).

According to Das et al., (2021), hospital waste is classified as chemical waste, medical waste, radioactive waste, pharmaceutical waste and general waste. Infectious waste however, includes sharps (e.g. needles), laboratory waste (e.g. blood specimen), human tissue (e.g. placenta) and cadavers used for research purposes. Each category of waste therefore, must be disposed of correctly according to specific guidelines in order to protect health care workers, ward cleaners, laundry workers and patients from needle stick injuries and even biological hazards.

Management of Infectious waste entails from point of generation to the point of disposal. Proper segregation of infectious waste from point of production is very cardinal in its' management. The process of waste management involves correct disposal of infectious waste which is separated at the point of generation in colour-coded containers, followed by its disposal. Bins are therefore, provided in all locations where healthcare waste maybe generated for segregation purposes. These include; sharps bins and needle/hub for used needles, high risk waste bins for infectious waste such as cultures and general waste bins for recyclable waste. The practice offers prevention of needle sticks and illicit reuse of syringes. From the colour-coded containers, infectious waste is disposed of through incineration, sterilization, chemical disinfection or burial in a secured landfill with enough space to avoid overflow and secured from unauthorized persons, pests and disease vectors. Sharps such as hypodermic needles, pipettes, scalpels, broken glass and blades are disposed of through incineration, chemical disinfection and autoclaving. Laboratory waste which includes body fluids, human tissue, fetuses, cadavers and cultures are as well disposed of through incineration or chemical disinfection (Makhuru et al., 2016).

The process of disposal involves transportation of the infectious waste to the disposal site which is done through open trucks with potential to spread the infectious agents into the air and infect the hospitals and neighbouring surroundings (Thakur et al., 2021). It is therefore very cardinal to be compliant with national transport regulations during transportation of infectious waste. Furthermore, ensuring that infectious waste is separated out at the point of generation, appropriately treated and correctly disposed of is very essential (Makhura et al., 2016). This is in line with WHO policy and Environmental Management Agency (EMA) guidelines on health care waste management**.**

According to Thakur et al., (2021) the rate at which infectious waste is being generated is higher in developed countries in comparison with developing countries due to high usage of disposable instruments and increased level of packaging. The global health care system expands tremendously in many developed and developing nations allowing the provision of health care to cover a wide range of people and more sophisticated treatments are offered to the patients. However, with the advancement in health care, a silent and huge neglected crisis is unfolding of a growing amount of waste that is not being properly treated leading to excessive carbon emission and waste of resources causing enormous suffering and pollution to the environment. Environmental and public health are therefore threatened by the combination of toxic and infectious pathogens as well as other medical waste properties (Faiza et al., 2019).

Management of infectious waste is a human health and environmental burden that should be solved for improving sustainability (Ferronato et al., 2020). Many developing nations face challenges in the effective management of infectious waste, and most of these challenges lie within the healthcare facilities (Olaniyi et al., 2021). Furthermore, in low and middle-income countries (LMICs), the management of infectious waste is particularly challenged due to insufficient knowledge on infectious waste management (Hangulu and Olagoke, 2017). Policy measures and training modules by WHO, however, have been put in place to curb for the proper management of infectious waste in order to provide a sound environment in line with Sustainable Development Goals (SDGs) in particular SDG number three (3). Despite all these measures infectious waste management system is still poorly managed, and rules remain mainly on papers (Thukaret al., 2021).

Zambia's general hospitals in Lusaka are no exceptional from the challenges faced with proper infectious waste management. According to Japan International Cooperation Agency (JICA) (2022), Lusaka province had a population of 3.36 million which increased by 1.17 million from 2.19 million, with an annual average increase rate of 4.4%. On the other hand, Lusaka City (Zambia's Capital) had a population of 2.73 million increased by 980,000 from 1.75 million in 2010, with an annual average increase rate of 4.6% as of 2022 (JICA, 2022), with five (5) general hospitals that were upgraded in 2020 from first level hospitals in order to enhance service delivery and reduce the burden on tertiary hospitals (University Teaching Hospital and Levy Mwanawasa

University Teaching Hospitals). The increase in population and the upgrade of the hospitals has led to an increase in the generation of healthcare waste leading to improper management of infectious waste, this is supported by Hangulu and Olagake, (2017) who submit that most landfills and bins are open to the general public thereby exposing them to injury (Hangulu and Olagoke, 2017).

In health facilities, improper disposal of infectious waste poses direct and indirect health impacts not only to health workers in within facilities but extends to the environment and the neighbouring communities. A number of health workers have been on Post Exposure Prophylaxis (PEP) due to improper storage and disposal of IW. Odonkor and Maami, (2020), alluded that the generation of infectious waste is an integral part of the healthcare operations and improper infectious waste management and disposal can be detrimental to humans and the environment at large. Therefore, health care workers have a huge responsibility to protect the community and other workers by correctly disposing of IW. Challenges in managing IW include lack of knowledge inadequate funding non-compliance with guidelines, insufficient resources (Olaniyi, 2020).

In Zambia, literature review shows dearth of information on infectious waste management, Hence the need for the researcher to carry out the study on infectious waste management.

### 1.1 Problem Statement

Safe management of IW is crucial for the provision of quality healthcare, patient protection, staff safety and environmental safeguarding (WHO, 2017). However, the rising number of private clinics/hospitals and the growing population have led to an increase in waste generation resulting in improper management and serious problems in healthcare facilities such as transmission of infectious diseases, proliferation of vector-borne disease, and pollution of water impeding the actualization of the United Nations SDGs number three (3) on good health and well-being, number six (6) on clean water and sanitation and number 12 in ensuring safe disposal of waste. To address these challenges, Zambia has adopted the Health Care Waste Management guidelines and policies in line with the Environmental Management Agency No. 12 of 2011 (formulation and provision of standards and regulations for the sound management of waste) by the Environmental Management Agency (ZEMA) in collaboration with Ministry of Health (MOH). However, a review of literature shows glaring gaps in the management of infectious waste. Inadequate management of infectious waste in general hospitals in Lusaka Zambia has led to numerous accidents and exposure to infectious diseases, and the current state of waste management falls short of WHO standards. Currently there is inadequate information on the management of infectious waste in the general hospitals in Lusaka. This study therefore, aimed at investigating what was obtaining at general hospitals and document qualitative aspects of infectious waste management to fill this knowledge gap and enhance proper management of infectious waste.

## 2.0 LITERATURE REVIEW

According to WHO reports in Oroei et al., (2014) indicated that higher levels of infectious wastes were generated from developing countries, with reasons being lack of awareness by healthcare workers concerning what infectious waste management was, regulations and standards that concern proper segregation.

A continuous training on infectious waste was therefore suggested for health care workers to try and control the plague of infectious conditions with potential to harm both the patient and health care provider as well as the community at large (Kumar et al., 2015; Ghasemi and Yusuff, 2015; Hangulu and Olagoke 2017). In some cases, the inadequate management of infectious waste was mainly due to lack of finances, shortage of manpower and above all the improper management of waste in the health care sector, which has been a major concern to hospitals and communities at large (Bhardwa and Josh 2016). Dewi (2020) on experiences dealing with waste in Indonesia, added that obstacles in medical waste emanated from various sides both in terms of human, equipment, policies and the environment, and further purported that those obstacles from the human side included lack of knowledge, motivation and co-ordination in managing medical waste as well as lack of monitoring and supervision from leaders in waste management.

Kenny and Priyadarshini (2021), alluded that the incorrect disposal of waste is as a result of a wide range of potential factors, such as lack of facilities, equipment and lack of education and training. Sound management of infectious waste is thus a crucial component of environmental health protection. Countries including Australia, Brunei Darussalam, Cambodia, China, Fiji, Japan, Kiribati, the Lao People's Democratic Republic, Malaysia, the Marshall Islands, Micronesia (the Federated States of), Mongolia, Nauru, New Zealand, Palau, Papua New Guinea, the Philippines, the Republic of Korea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu and Viet Nam in the Western Pacific Region have national policies, guidelines and action plans including best practices for the management of infectious waste. However, the progress at which infectious waste is managed may have varied from country to country, as some might have been at a more advanced level of development than others (WHO, 2015). According Thukar et al., (2021) India had laid down a number of policies for regulating the hospitals on practices like segregation, collection, transportation, storage and disposal of infectious waste. However, in almost every part of the world, the management of infectious waste is very poor, and rules therefore, remain mainly on the paper. With the increase in incidence of chronic disease and sophisticated medical treatment, more infectious waste is generated than ever before resulting in the need to treat and dispose the waste according to WHO standards.

Zand and Heir (2021) revealed in their study that 40% of the total waste generated was infectious waste representing 1.6 kg/day/bed which was much higher than the WHO estimation value for hospitals which is less than 15%. Furthermore, the ineffective waste separation programs also increased the generation rate of infectious and associated treatment costs in comparison with other

countries. In addition, Joshi et al., 2017 on health care waste management practice at health care institutions of Nepal, findings revealed that teaching hospitals produced more infectious/ medical waste compared to standard health care institutions, furthermore their findings revealed that most health care/ infectious waste was not disinfected prior to disposal. Guidelines on health care waste management were not adhered due to high patient in-flow rate against the bed capacity.

Naz et al., (2020) on knowledge, attitude and practice regarding management of health care waste among private dental practitioners, it was stated that effective management of infectious waste essentially depended upon proper identification and segregation of the waste in line with the recommended waste management guidelines. However, management of medical waste including infectious waste was handled poorly extending regulations that govern medical waste procedure (Al-Momani et al., 2019).

According to Hassan et al., (2018), infectious waste represented a major public health issue, especially in developing countries with sharps waste being the most hazardous. Sharps can predispose health workers and handlers to blood-borne pathogens, hence the need to manage them in an effective manner (Hassan et al., 2018). In a study done by Olaniyi et al., (2021) on challenges of effective management of medical waste in low-resource setting in south Africa, the study findings reviewed that the challenges identified by healthcare workers included poor understanding of medical waste management guidelines as well as poor compliance; lack of regular training; poor attitudes of medical waste generators; insufficiency of waste management equipment and sub-standard central storage rooms.

A study by Makhura et al., (2016) in Mpumalanga Province in South Africa, showed that there is insufficient knowledge of infectious waste disposal among health care workers. Nevertheless, correct infectious waste disposal practices were followed by more than half of the health care workers and among these nurses comprised the highest proportion of professionals adhering to standard infectious waste handling guidelines. The aforementioned is supported by Olaniyi et al., 2021, who submitted that efforts should be intensified towards adequate training of healthcare waorkers as well as provision of necessary equipment for effective management of infectious waste.

According to Yazie et al., (2019) improper infectious waste management leads to the transmission of more than 30 dangerous bloodborne pathogens. This is actually a major concern for healthcare facilities for it has proven to transmit infectious diseases such as Human Immune-deficiency Virus (HIV), Hepatitis C and B viruses as well as respiratory and enteric soft tissue infections among healthcare workers and other exposed individuals (Hangulu and Olagoke 2017). The World Health Organization estimated that each year there are about 8-16 million new cases of Hepatitis B virus (HBV), 2.3-4.7 million cases of Hepatitis C virus (HCV), and 80,000 to 160,000 cases of HIV due to unsafe injections and mostly due to very poor HCW management systems (Tope 2018).

A study by Hassan et al., (2018), in Sudan on healthcare waste management showed that all waste was mixed together and improperly disposed, especially infectious waste like used needles due to lack of waste segregation at the source, lack of policies, inadequate training, lack of knowledge of hazardous waste including its effective treatment. Yazie et al., (2019) supports the aforementioned that lack of awareness by healthcare workers and improper waste management utilities contribute to ineffective management of medical waste including infectious waste. A study by Govender et al., (2018) on Knowledge, Attitude and Practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Nata, revealed inadequate knowledge of healthcare providers on Health care waste management and a good attitude towards the appropriate disposal of Health care waste however, a few demonstrated good practices of health care waste management. Furthermore, a study by Gizalew protocols for managing health care waste, leading to substandard practices putting staff and patients at risk of exposure to infectious materials, such as needle sticks.

According to Tope et al., (2018) studies have showed that there was poor management of medical waste in developing nations including Nigeria. Safe handling of infectious waste from point of production to the point of disposal was very vital and Un-like domestic waste, infectious waste was not disposed of through regular channels due to its infectious characteristics. According to the guidelines, infectious waste should be separated at point of production through colour coding of bins or bin-liners which should be followed by treatment. The most common management method for infectious waste, sharps and pharmaceuticals is incineration. However, public nuisances and protests for incineration facilities have contributed to accumulation of waste in certain hospitals (Silva and Gunawardena., 2019). Concerns were raised of infectious waste having been disposed of with domestic waste resulted into grave consequences. Moreover, Yazie et al., 2019 emphasized the need for close supervision of the waste disposal process by the regulatory bodies to be adhered to. In addition, appropriate training was relevant as well as ongoing in-service training was required to ensure appropriate knowledge, attitudes and safe practices among all healthcare providers (Govender et al., 2018).

In Kenya Most healthcare facilities lacked enforcement of existing legislation for management of healthcare waste through handling, and disposal of health care waste, the issue was exacerbated by the fact that regulating bodies were short of a systemized oversight plan of ensuring compliance (Hariz et al., 2017).

Providing training on medical waste management is vital to encourage and ensure safe practices among health-care providers with more attention on health-care attendants so as to close the yawning gap in their practice level of medical waste management. Gizalew et al., 2021 further alluded that application of standard management of infectious waste which included planning, implementation, and monitoring of activities with the purpose of preventing contact, enabling the

care of customers and professionals involved thereby preventing the incident of ecological influences while reducing the production of waste.

The Government of the Republic of Zambia provides its health services following the principles of the 3 Cs which include; Clean environment, Caring system and Competent work force. …….. In providing care, various types of waste are generated and categorized as either hazardous or non –hazardous. Guidelines have been put in place to manage healthcare waste in Zambia which includes infectious waste, however, healthcare waste management still remains below minimum national and international standards causing significant risks to health care providers (WHO, 2019). In addition, Zambia developed and adopted her first edition of Infection Prevention Guidelines in 2003 by the then Central Board of Health with the purpose of developing the Infection Prevention Guidelines to provide standard guidelines for infection prevention practices applicable at all levels of the health care system in Zambia such as good solid waste (CBoH, 2003; M'hango, 2021). In a study by Kambamba et al., (2021) on Knowledge, Attitude and Practice on disposal method of expired and unused medicines findings revealed that participants had a low level of knowledge on safe disposal methods of expired and unused medicines.

According to WHO, (2019) the 2009 general auditor's report on medical waste management in the health institutions revealed serious weaknesses on waste management practices from point of waste generation to point of waste disposal. Consequently, due attention was not given to the quantities of waste generated, colour codes and labelling of containers, improper and ineffective treatment of waste and lack of healthcare waste management protocol and orientation of members of staff in healthcare waste management. The status quo has not changed since 2009 vis-a-vis the findings by WHO in 2015.

In the management of infectious waste, Zambia adopted WHO's recommended use of safety boxes for the containment of all sharps generated in health care settings and the construction of macro burn incinerators supported by WHO and United Nations Children's Emergency Fund (UNICEF)(WHO,2015). However, many healthcare facilities were not responsible for the waste they generated and the implication it had on the environment and public to ensure safe, efficient, sustainable and culturally acceptable methods for collection, storage, transport and final disposal both within and outside the premises. Large hospital in Zambia had incinerators for disposing of infectious waste while rural-based facilities used pits or burning chambers for disposal. However, many of these incinerators did not meet the environmentally acceptable standards and legal requirements for air emissions or waste disposal. As a result, healthcare waste had been observed at disposal site for general waste where scavengers had access unfortunately without necessary measures to control (CBoH,2003; WHO, 2015).

A new Joint Monitoring Program of WHO/UNICEF report in 2019 revealed that there was inadequate safe management of infectious waste in developing countries in that only 27% of healthcare facilities had basic waste management services (Lemma et al., 2021). Zambia is no

exceptional to these challenges as evidenced by MoH assessment on HCWM that included infectious waste which was reported to be generally unsatisfactory at all levels of health care delivery (MoH, 2019).

### 2.1 Conceptual Framework

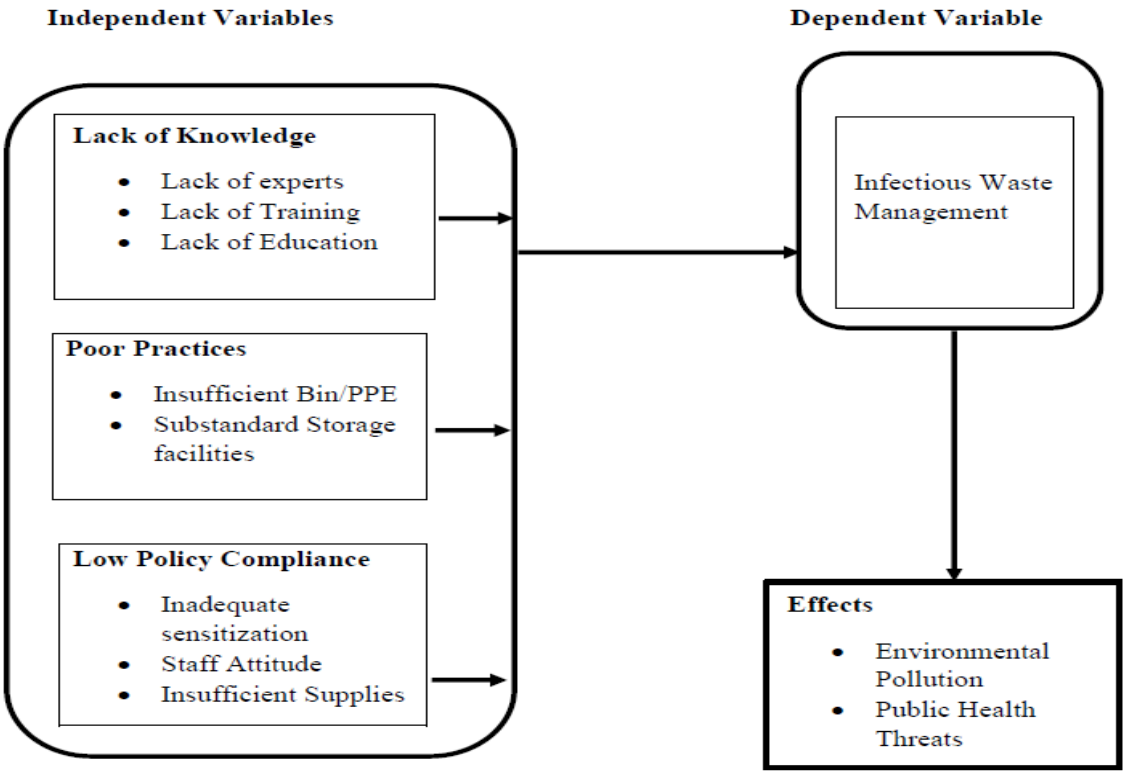


*Figure 1: Conceptual Framework*

*Source; Researcher (2022)*

### 2.3 Research Gaps

From the literature reviewed, the following research gaps were identified which includes; lack of knowledge on the management of infectious waste in these hospitals, inadequate information on proper management of infectious waste, lack of regular staff training on infectious waste management, lack of equipment and protective clothing for waste handling, limited space for storing waste before transportation for disposal, lapses in the policy and guideline implementation of infectious waste, and even inadequate research on the transmission of infectious diseases through improper infectious waste management.

## 3.0 MATERIAL AND METHODS

**Study Design:** Explorative qualitative study.

**Study Location:** In the five (5) general hospitals in Lusaka, Zambia. These were Chilenje, Kanyama, Chipata, Chawama and Matero general hospitals.

**Population:** The target population was composed of the following health workers from the five (5) general hospitals in Lusaka. One (1) Environmental health technologists because they are responsible for monitoring and enforcing health and hygiene legislation, investigate incidences such as pollution, toxic contamination and advise employers about matters of environmental health, One (1) Infection prevention control officer because they promote best infection control practices in order to ensure the delivery of a quality service for patients, visitors and staff by providing advice on management of patients with infections. One (1) Laboratory technologist because they obtain specimens, cultivate, isolate and identify microorganisms for analysis and they also conduct chemical analysis of body fluids, including blood and urine to determine presence of normal and abnormal components, ten (10) nurses and ten (10) doctors per facility.

**Sample And Sampling Techniques:** Utilized snowball sampling. All participants were accessed through the referrals by the senior medical superintendents (SMSs) of the facilities because they are responsible for all activities that take place in these facilities. All participants were chosen using purposive sampling

**Data Collection:** An interview guide with open-ended questions and an observation guide

**Statistical Analysis:** Thematic Data Analysis

## 4.0 FINDINGS

### Participant Demographics

The section below shows the demographic characteristics of the respondents

### 4.2.1 Age

The findings from table 1 below show that from a majority (n=9; 34%) were aged between 25<30 years of age followed by those aged 31<36 (n=6; 29%). The least were those aged above 50 years (n=1; 5%), 18<24 (n=2; 10%) and 44<50 (n=2; 10%) respectively.

**Table 1: Showing Respondent's Age**

| n=21 Variable | Frequency (x) | Percentage (%) |
|---|---|---|
| **Participants Age in years** | | |
| 18<24 yrs. | 2 | 10 |
| 25<30 yrs. | 9 | 43 |
| 31<36 yrs. | 6 | 29 |
| 37<43 yrs. | 1 | 5 |
| 44<50 yrs. | 2 | 10 |
| Above 50 yrs. | 1 | 5 |
| **Total** | **21** | **100** |

*Source: Author: field survey 2022*

### 4.2.2 Gender

Finding in fig 1 below show that majority of the respondents were Females (n=18; 62%) while males represented n=8 (38%) representing a gender ratio of 2.63 females to 1.62 males respectively.

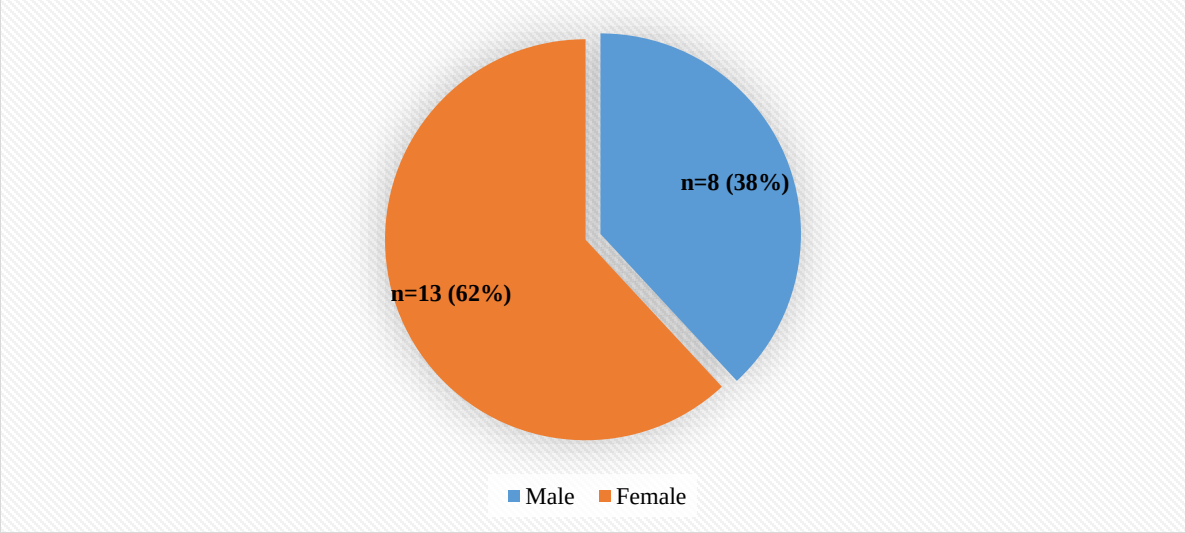


***Figure 1: Showing Respondents Gender***

*Source: Author: field survey 2022*

### 4.2.3 Respondents Distribution by Health Facility, Current Roles and Department

The table below show that Environmental Health Technologist represented the majority of those interviewed (n=8; 38%) compared to lab technologist who represented n=5; 24%, and Registered Nurses representing n=4; 19%, as well as Clinical Officers representing n=2; 10%. The least were the Maids who just represented n=1; 5%. By observation key department that produces or handled infectious waste were represented in all the general hospitals where study participants were drawn.

**Table 2: Showing Respondents Distribution by Health Facility Current Roles and Department**

| Participant Number | Current Role | Department | Health facility | |
|---|---|---|---|---|
| P1 | Environmental Health Technologist Zonal | Environmental Health | Matero Hospital | General |
| P2 | Environmental health technologist | Environmental Health | Matero Hospital | General |
| P3 | Environmental health technologist | Environmental Health | Kanyama hospital | General |
| P4 | Environmental health technologist | Environmental Health | Kanyama Hospital | General |
| P5 | Clinical Officer | Outpatient department | Kanyama Hospital | General |
| P6 | Clinical Officer | Outpatient department | Chawama Hospital | General |
| P7 | Environmental Health Technologist | Environmental Health | Chipata Hospital | General |
| P8 | Environmental Health Technologist | Environmental Health | Chipata Hospital | General |
| P9 | Biomedical Technologist | Laboratory | Chipata Hospital | General |
| P10 | Lab scientist | Laboratory | Matero Hospital | General |
| P11 | Biomedical Technologist | Laboratory | Kanyama Hospital | General |
| P12 | Medical Lab Technician | Laboratory | Chawama Hospital | General |

| | | | | |
|---|---|---|---|---|
| P13 | Environmental health technologist | Public Health | Chawama Hospital | General |
| P14 | Environmental Health Technologist | Environmental Health | Chilenje Hospital | General |
| P15 | Registered Nurse | In patient | Kanyama Hospital | General |
| P16 | Registered Nurse | Labour ward | Matero Hospital | General |
| P17 | Registered Nurse | Outpatient department | Chipata Hospital | General |
| P18 | Maid | Physiotherapy | Chilenje Hospital | General |
| P19 | Registered Nurse | Maternal Child Health | Chilenje Hospital | General |
| P20 | Biomedical Technologist | Laboratory | Chilenje Hospital | General |
| P21 | Registered Nurse | Paediatrics | Chawama Hospital | General |

*Source: Author: field survey 2022*

### 4.2.4 Highest Level Of Academic Or Professional Qualification Obtained

The findings in Fig 2 below show that from a majority (n=13; 62%) were diploma Holders while n=6; 28% were holders of a Bachelor's degree and the least (n=1; 5%) had a master degree and a school certificate respectively. Overal it was observed that these qualifications were enough to warrant good understanding about infectious waste management in the general hospitals.

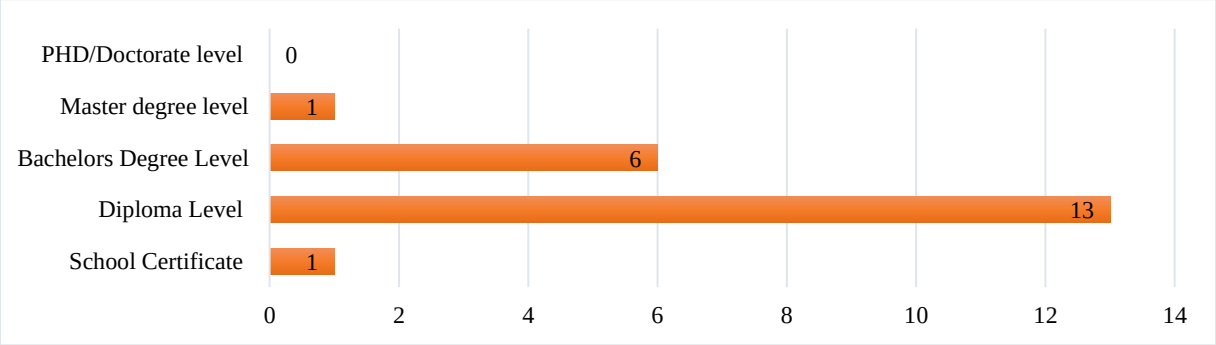


***Figure 2: Showing Respondents Highest Level Of Academic Or Professional Qualifications Obtained***

*Source: Author: field survey 2022*

### 4.2.5 Years Respondents Worked in Current Role

The findings in fig 3 below revealed that majority n=10; 50% of the respondents have worked 2<5 years in their current role while n=5 25% have worked 6<10 (n=years with the least being those that have saved n=111<15 yrs., n=1; 21<25 yrs., and n=1; 16< 20 yrs., respectively. Only n=2; 1

0% of the respondents had served <1 year work experience in their role as compared to the minority (n=6; 28%). The findings also validate that, each health facility has very well experienced environmental health technologist with vast knowledge of infectious waste management in general hospitals in Zambia.

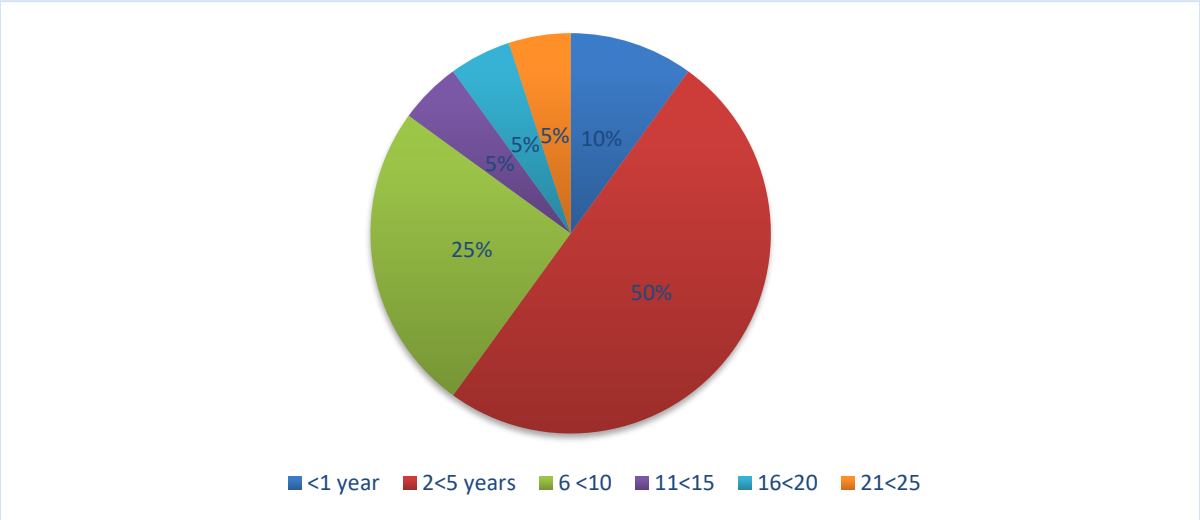


***Figure 3: Showing Years Respondents Have Worked In Their Current Role***

*Source: Author: field survey 2022*

### 4.3. Knowledge Levels Of Health Workers Regarding Infectious Waste

Overall, the finding in all health facility revealed extensive knowledge about infectious waste by the n=21; 100% respondents. They had adequate information on the importance of infectious waste management and the effects of poor infectious waste management on their own heath and the environment.

However, the general observation and commentary by the respondents was that not all health workers had a demonstrated sense of responsibility towards safe handling and disposal of infectious waste. On participant remarked:

*"While we are all aware of the types of waste generated in the health facility yet the attitude and behaviour of many…… in the way we handle or treat medical waste suggest a lack of awareness about the health hazards related to health-care waste*." *[Provider at Kanyama General Hospital]*

It was also observed and verified that most of the health workers did not have adequate training in proper waste management, as expressed by some health workers interviewed:

*"No I didn't receive any training on handling infectious waste…… but sometimes we have in house training we are just taught by maybe the EHT's or maybe a few people from PHO just to teach us a few things …..In house training is not so often, I can say maybe once in 6 months." [One provider Remarked, Chipata General Hospital]*

*"The maids or general clearers are the ones that help us to clean the floor are the ones that are responsible to empty the waste. Am not aware if they are trained in handling infectious waste ……..or if there is that proper formal training for them." [Remarked one provider at Chawama General Hospital]*

### 4.4 Common Type Of Waste Generated In The Health Facility By Health Workers

The findings in table 4 below reveals that while waste was generated at all lines of duty, the opinion of the majority (n=13; 61.91%) was that radioactive waste was the least (lowest) generated. Nevertheless, it was clear from the findings in the table below that infectious waste and biohazard waste was the most frequently generated in all departments by health workers while performing their duties.

**4.4 Table 3: Waste Generated By Health Workers While Performing Their Duties**

| n=21 Variable | Lowest | Low | High | Highest |
|---|---|---|---|---|
| **Rank the type of Waste gernerated you while perfomring your line of dutiy in the oder of lowerst to heighest** | | | | |
| **General waste** | 5 (23.81%) | 3 (14.29%) | 4 (19.05% | 9 (42.85%) |
| **Infectious waste** | 2 (9.52%) | 3 (14.29%) | 11(52.38%) | 5 (23.81% |
| **Biohazard waste** | 3 (14.29%) | 3 (14.29%) | 7 (33.33%) | 8 (38.10 % |
| **Radioactive waste** | 13 (61.91%) | 6 (28.58%) | 1 (4.76%) | 1 (4.76%) |

*Source: Author: field survey 2022*

Table four above also revealed general waste was also generated and was actually the most predominantly visible waste within the hospital setting yet only n=9 (42.85%) acknowledged producing this kind of waste in their line of duties. A further investigation revealed that health workers regarded generation of this kind of waste as a collective responsibility of health staff across all departments and by the general health clientele (Patients and the community members visiting the Hospitals).

Nevertheless, concerning general waste respondents were aware that it was potentially an issue in effective medical waste management with some respondents having remarked that:

*"In most cases while it is not an infectious waste this kind of waste still pose both environmental and health risks as most of it was disposed of by burning in open pits or in incinerators causing pollution*." *[Respondent at Matero General Hospital]*

*".... and if not disposed properly it attract scavengers both human and animal that are keen to salvage anything that they think is of potential value to them rendering it a vehicle for some infectious agents in the community." [Respondent at Chipata General Hospital]*

*"The risk of this king of waste was that it not sterilized before disposal as such, it has potential to be contaminated by infectious agents within the hospital settings and if not collected of disposed of properly it attracts zoonotic animals and vectors that intern transmit some of the vector and zoonotic infections." [Respondent at Chilenje General Hospital]*

### 4.3.1 Attitude of Health Providers Towards Infectious Waste Management

The scores relating to the attitude of the respondents to infectious waste are summarized (Table 3). It was found that majority n=18 (85.7) % of the respondents had a negative attitude towards medical waste management.

**Table 4: Attitude Of Health Providers Towards Infectious Waste Management**

| **The Responses to the Items Relating to the Respondents Attitude Towards MWM.** | |
|---|---|
| **Attitudes towards MWM** | **(n = 21), n (%)** |
| **Positive** | 3(14.3%) |
| **Negative** | 18 (85.7%) |
| **Undecided** | 0 (00%) |

*Source: Author: field survey 2022*

The findings show that the majority (n=18; 85.7%) of the respondents had a demonstrated a negative attitude toward medical waste management. Majority argued that it was a preserve of the environmental health technologists and maids when in fact it was them health providers producing various kind of medical waste in their line of duty. Some participants categorically said:

*"The attitude of health workers at our facility when it comes to handling infectious waste from my experience is negative .... you have to remind them every now and then... some of them are very good and some of them of course they may have the 'I don't care attitude,' but if you remind them*

*continuously they learn eventually they do what they are supposed to do but its continuous." [Participant, Matero General Hospital]*

"" *Like the one who just discussed the attitude of staff……. sometimes the bin is there some wont segregate, the sharp box is there someone wont segregate or the sharp box is there someone won't just put in the sharp box they will mix the waste but of course if you talk to them they change" [Participant Chawama General Hospital]*

### 4.4 .1 Waste Management Practices In The Various Department

#### 4.4.1.1 Waste Handing Containers And Bin Liners

It was clear from observations that there were no standard waste handling containers in all the general hospitals departments. Stock outs and under supplies of standard waste handling containers necessitated various inter- departmental innovation just to ensure that waste was somehow handled with less chances of having it mixed-up.


*Photo of indoor medical waste management practices in the study area picture taken by Author 2022*

Conversely, when the participants were interviewed whether this lack of standard waste handling vessels was posing any problem for them. This is what they had to say:

*"Labelling the containers when one colour code was not an option was common, however, this kind of initiatives often led to frequent mixing of infectious waste with other medical waste and often resulted in one kind of occupational health and safety accidents such as getting pricked with contaminated sharps that have wrongly been mixed with general waste." [Participant at Kanyama General Hospital]*

**"**Some of us have ended up taking Post exposure prophylaxis, Hepatitis or tetanus jabs because of frequently falling victims of pricks form contaminated sharps while handling waste that was not properly separated at the point of generation." *[Lamented one Maid at Chilenje General Hospital]*

### 4.4.2 Amount Of Waste Generated Per Month At Each General Hospital

**Table 5. Showing The Amount Of Infectious Waste Generated In A Month And Weighing Practice**

| **n=21 Variable** | **Estimated quantity (Kgs)** | |
|---|---|---|
| **How much infectious waste does your hospital generate in a month?** | | |
| Matero General Hospital | 50 | |
| Chipata General Hospital | 20 | |
| Chilenje General Hospital | Not data | |
| ChawamaGeneral Hospital | Not data | |
| Kanyama General Hospital | 400 | |
| **n=21 variable** | **Freq.** | **Percentage** |
| **How often is medical waste weighed before disposal at department level/or collectively as a hospital** | | |
| Always | | |
| Sometimes | 5 | 24 |
| Never at ALL | 14 | 67 |
| Don't Know | 2 | 10 |
| **Total** | **21** | **100** |

*Source: Author: field survey 2022*

The findings revealed that health facilities were not weighing the waste they generated in their facilities as such it was difficult for them to produce data regarding the quantities of waste rather just estimates.

### 4.4.3. Waste Disposal Storage Management Practices Observed Onsite


*Photo of indoor medical waste management practices in the study area picture taken by Author 2022*

The pictures above clearly reveal that waste management practices in the general hospitals is poor and below the standards set in the WHO and national medical waste management guidelines. From the pictures it is clear that surrounding communities and the natural environment health workers and customers are at potential health risk.

### 4. 5 Policy Compliance Levels Of Health Workers Towards Infectious Waste Management

The findings show that only one health facility had written policies and protocols stack on the walls out the five general hospitals. Even then, the policies, were only stack in selected departments mainly in the Environmental health technologist. It was however, noted that health workers were dependent on the environmental health technologist or officials from the ministry of health and stakeholders to remind them of the policy, an event which was dictated by availability of funds. Most policies are still on soft copies and books which not everyone easily had access to.

**Table 6: Showing Responses On Policy Compliance Levels Of Healthcare Facility Towards Infectious Waste Management**

| n=21Variable | Frequency | (%) |
|---|---|---|
| **Policy compliance levels of health workers towards infectious waste management** | | |
| **Very High** | 2 | 10 |
| **High** | 3 | 14 |
| **Low** | 16 | 76 |
| **Very low** | 0 | 0 |
| **Total** | **21** | **100** |

*Source: Author: field survey 2022*

The majority of health workers were of the perception that policy compliance levels of the health care facility toward infectious waste management was low (n=16; 74%). This was further amplified by respondent's remarks such as:

*"Yes there is need for the rules and regulations to be improved, maybe mentoring people more because cause we are having many new people on the ground every day and they don't have this knowledge, so at least if we can mentor these people every time we have a new group of staff and also maybe pictures that would be of help" [Respondent at Chilenge General hospital]*

*"Just go round the health facility and tell me whether what you see at the storage and disposal facilities is how standard medical waste management looks like….. Management need to increase support to the environmental health department and ensure everyone is inducted in policy and standard waste management." [Respondent at Chipata General Hospital]*

### 4.6 Factors Impeding Proper Infectious Waste Management

The findings relating to the factors impeding a proper infectious waste management challenges facing health workers in handling infectious waste generated while performing their duties are summarized (Table 6).

**Table 7: Showing Responses Of Factors Impeding A Proper Infectious Waste Management**

| n=21 Variable | Weighted score (21/21) | Percentage (%) |
|---|---|---|
| **Factors impeding a proper infectious waste management** | | |
| Limited storage space before collection and transportation to the disposal site. | 10 | 6 |
| Stock out of colour coded bin liners and Bins | 17 | 10 |
| Poor attitude of infectious waste generators | 16 | 9 |
| Inadequate of protective clothing for waste handling | 17 | 10 |
| Poor understanding of infectious medical waste management practices | 16 | 9 |
| Mixing of infectious waste with general waste poses a great risk for me | 13 | 7 |
| Inconsistent waste collection schedules | 16 | 9 |
| Poor understanding of infectious waste | 3 | 2 |
| Poor compliance to waste management guidelines | 12 | 7 |
| Lack of regular training | 21 | 12 |
| Substandard central storage rooms | 16 | 9 |
| Insufficient infectious waste management equipment | 19 | 11 |
| **Total** | **176** | **100** |

*Source: Author: field survey 2022*

It is clear from the findings in the above table that majority needed regular training (n=21; 12%). On the other hand there was insufficient infectious waste management equipment (n=19; 11%) at the same time protective clothing for waste handling was inadequate. Stock out of colour coded bin liners and bins was a common occurrence (n=17; 10 %).

Furthermore, the available central storage rooms were of substandard (n=16; 9%). Additionally, inconsistent waste collection schedules, poor attitude of infectious waste generators and poor

understanding of infectious medical waste management practices was identified among factors impeding a proper infectious waste management (n=16; 9%) respectively.

On the other hand, mixing of the waste and poor compliance to waste management guidelines was perceived as another challenge of moderate parlance (n= 12; 7%). Additionally, the finding revealed that, understanding of infectious waste was not considered a key challenge as most health workers understood clearly what an infectious waste was.

### 4.6.1 How Often The Challenges Associated With Infectious Waste Handling And Management Affect Health Worker In There Line Of Duty

The general responses of the majority as shown in Figure 4 below was that n=18 (86%) did agree that the challenges associated with infectious waste handling did affect them while performing their duties. Some of the most observed challenges included coming into contact with infectious waste accidentally or during handling or transportation to the refuse bay. Others are just administrative such as stock out of gloves, bin liners and broken-down incinerators and delay in collection of waste which sometimes attract scavengers from the communities who put others at risk in the community by taking infectious waste to their homes.

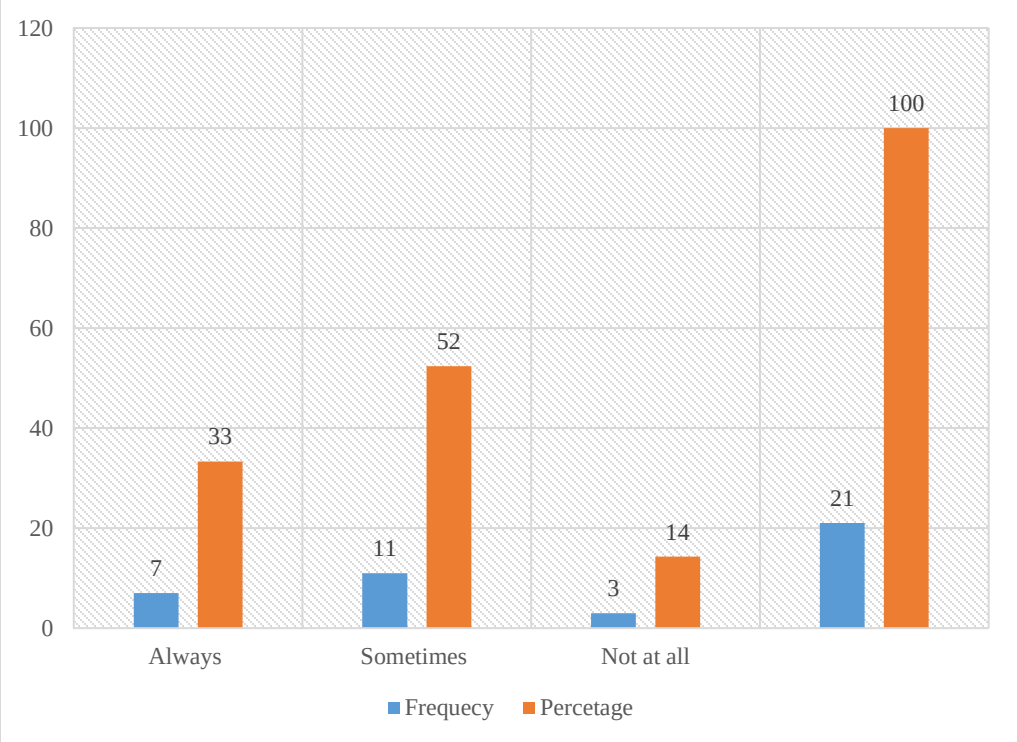


*Figure 4: Showing How Frequent Health Workers Face The Challenges Associated With Infectious Waste Handling*

*Source: Author: field survey 2022*

### 4.6.2 The Reasons For Having Such Challenges Regarding Handling Of Infectious Waste

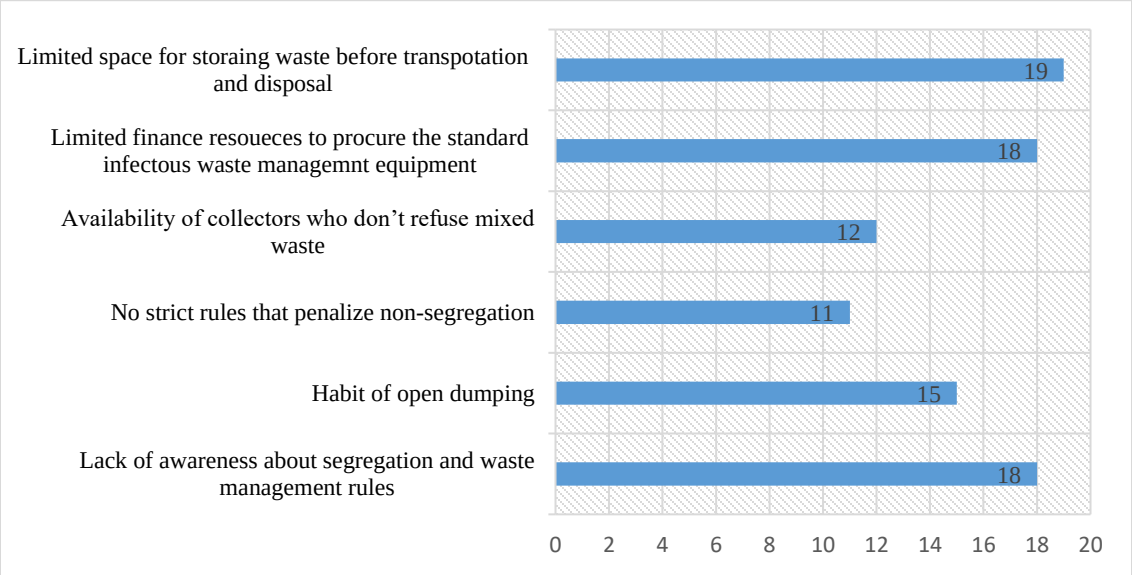


***Figure 5: Showing Reasons For Having Such Challenges Regarding Handling Of Infectious Waste***

*Source: Author: field survey 2022*

A myriad of reasons for having such challenges regarding handling of infectious waste were advanced. Those amplified are given in fig 5 below. I t is clear that limited space for storing waste before disposal or transportation (n=19 90.1%) and the lack of awareness about segregation and waste management rules (n=18; 86%) as well as the limited financial resource to procure standard infectious waste equipment (n=18; 86%) emerged among the major reasons for the challenges health workers are facing in infectious waste management

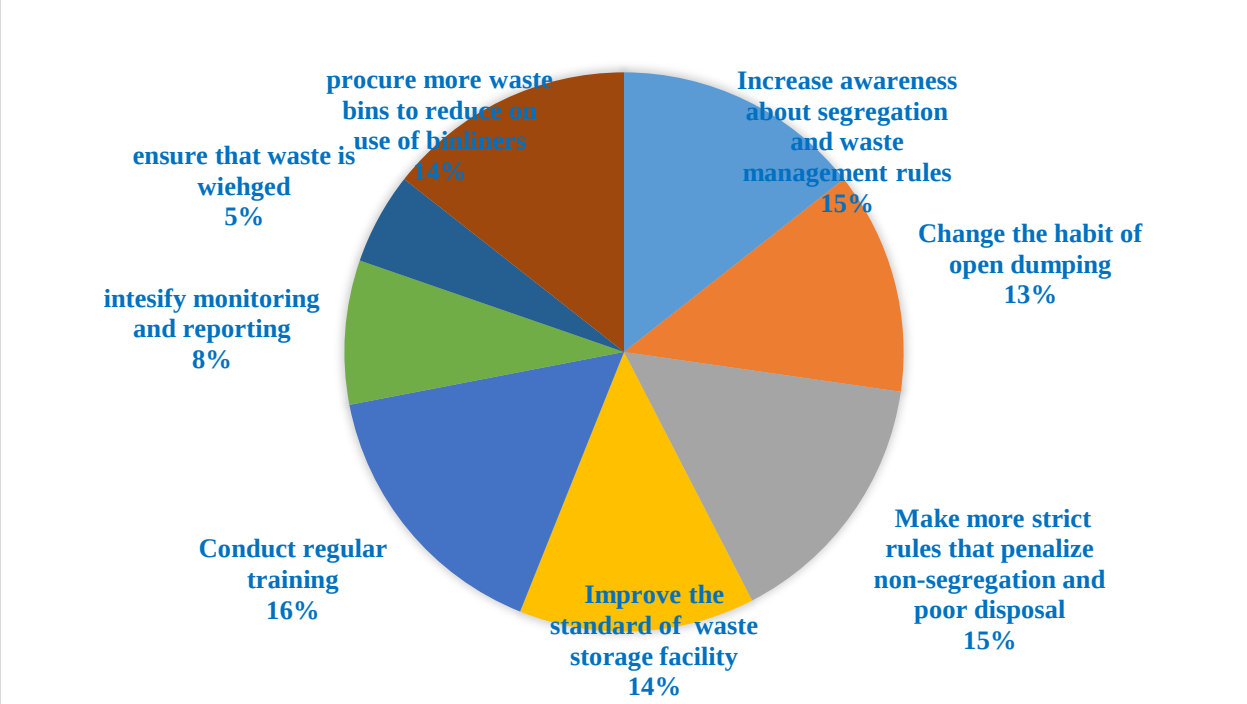


***Figure 6: Infectious Waste Management Improved Plan***

*Source: Author: field survey 2022*

The respondents revealed that regular training for health workers was of high occurrence (n= 21; 16%) this was followed by the following suggestions: make more strict rules that penalize non segregation and poor disposal of medical waste (n=20; 15%) increase awareness about segregation and waste management rules (n=19 (15%). Improve the standard of waste storage facility (n=18; 14%) and Change the habit of open dumping (n=17; 13%) respectively weigh the waste and intensifying monitoring and reporting were the least among responses. This clearly begs a question into the waste management practices.

The study also identified other practices that needed to be improved. One respondent had this to say:

*"Collection of waste is done once in a week for both domestic and infectious waste, collection is done every day every morning in all the departments from our refuse bay its done once in a week so I would say twice because domestic is collected on a different day, infectious is collected on a different day. "[Participant at Matero General Hospital]*

*Refuse bay this is where we throw the waste be it infectious domestic sharp it's a place where we store all that waiting for transportation of disposal site. No we don't dispose-off our waste our incinerator is down so we just hire a company to collect the waste, we have a company for domestic and a company for infectious waste. [Participant at Chilenje General Hospital]*

*at first I used to hear there is a place somewhere in Chunga right now I don't know where the company takes the waste, they have an incinerator that side for sharps. They come with a van big van and then they put the bags in the van, every week they come. [Participant at Kanyama General Hospital]*

*"We don't have proper transportation for waste, the ideal we are supposed to have a trolley where it is well covered it does not allow any leakages of waste in case they are fluids they is no leakages from the point of generation to the point of disposal. The waste is stored in plastics you find that they put them on the wheel chair they transport which is not ideal." [Participant at Chipata General Hospital]*

## Discussion

### 5.1. Knowledge, Attitude and Practice of Infectious Waste

In this study, the overall picture was that health care workers in the professional stratum such as nurses, laboratory technicians, environmental technicians, clinician's, doctors among others, underplayed health disposal practices despite them being the producers of such waste and health professional forerunners. This created an impression that the practice to dispose and transport infectious waste was not a collective responsibility but rather was a preserve of the environmental health technologist, occupational health and safety officer and the hospital maid or general workers. Unequivocally, the maids had no formal training in medical waste management and mostly were not adequately provided with personal protective clothing as such they would not risk segregating the waste bare handed.

Across the study area the waste management recommendations, policies and guidelines on proper handling and management of infectious waste (such as waste segregation and bin colour coding, transportation, disposal and storage) are still substantially undermined by a myriad interlinked factors such as inadequate knowledge levels, health workers' attitude and practices towards infectious waste management, low policy compliance levels of healthcare facility towards infectious waste. The findings are similar to that of (Makhura et al., 2016) which showed that there was insufficient knowledge of infectious waste disposal among healthcare workers. The practice of engaging a small private sector to participate in transporting hospital waste management was encouraging but adopting new technologies including innovation such as waste recycling development are potential to address storage and disposal issues as well as improve environmental outcomes associated with ground water and air pollutions as well as climate change. Failure to which will result in catastrophic health consequences for the health workers and communities around them.

Studies that support the findings of this study hold proper management of infectious waste in high escrow, as it is the only sure way of controlling its corresponding risks on health and to prevent the transmission of infectious conditions such as hepatitis, AIDS, and typhoid including the Covid-

19 pandemic which has led to increases in patient and healthcare activities and increased the waste generation and the proportion of infectious waste in the landfill (Peng et el., 2019–2020; Wang et al., 2020).

The current state of affairs observed in this study provide an opportunity for understanding the gray areas in infectious waste that are usually taken for granted. The study has shown that for most healthcare workers having knowledge was not indicative of their change in waste management practices as attitude and polices did have their fair toll on overall perception of waste management. Thus, a key challenge to deal with, in the long-term including transforming the mindset of health workers towards infectious waste management through training and policy compliance monitoring. This is because "poor management of infectious waste potentially exposes health care workers, waste handlers, patients and the community at large to infection, toxic effects and injuries, and risks polluting the environment. These findings are also in line with that of Hangulu (2017) and Kusilika (2021) which stated that poor infectious waste practices pre-disposes healthcare workers and the surrounding community to infectious diseases. It is essential that all medical waste materials are segregated at the point of generation, appropriately treated and disposed of safely.

Conversely the malfunctioning waste system that this study validated is a wakeup call for government and stakeholders to act now lest the country reach the tipping end waste management crisis in the health care units.

### 5.2. Policy Compliance Levels of Healthcare Facility Towards Infectious Waste

This study validated that, the state of infectious waste management in general hospitals in Zambia are still short of the World Health Organisation recommended standards. It is evidenced from the study findings that despite Zambia having adopted Health Care Waste Management (HCWM) guidelines and polices in line with the Environmental Management Agency (ZEMA) No. 12 of 2011, segregation, collection, transportation, storage and disposal of infectious waste and policy compliance was below expected standards.

Clearly, what was observed in this study, shows that having policies on paper or on soft copies was not adequate in changing health care workers' attitudes towards infectious waste management in health facilities. This study's revelations were also uncovered by Thukar et al., (2021) in India and in the WHO (2015) report which reported that, "in almost every part of the world, the management of infectious waste is very poor with most and rule and polices serving as a mere smoke screen and by and large, remain mainly on the paper."

### 5.3. Factors Impeding a Proper Infectious Waste Management

This study enunciated a series of decomposing factors of interest to the public health systems zeroing in those that primarily impeded proper infectious waste management in Zambia. Those amplified in this study include lack of regular training, insufficient infectious waste management

equipment and inadequate protective clothing for waste handling, stock out of colour coded bin liners and bins was a common occurrence. Kenny and Priyadarshini (2021), alluded that the incorrect disposal of waste is as a result of a wide range of potential factors, such as lack of facilities, equipment and lack of education and training and also a study by Olaniyi et al., (2021) on challenges of effective management of medical waste in poor low-resourse setting .The major challenges also included limited space for storing waste before disposal or transportation and the lack of awareness about segregation and waste management rules as well as the limited financial resource to procure standard infectious waste protection and disposal equipment. These findings relate well to Hassan et al., (2018) and Yazie et al., (2019) that factors attributing to improper disposal include; lack of awareness of waste segregation and inappropriate waste management utilities. Others observed included, inadequate management of infectious waste mainly due to inadequate waste collection vessels such as bin liners and bins lack, shortage of manpower and above all the improper management of waste in the health care sector. These observations were also noted in the literature of Bhardwa and Joshi (2016) and were considered to be of primary concern to hospital and communities at large.

In common parlance the revelation in this study begs a strong political will and further scientific inquiry into the interrelationships between various variable such as knowledge, policy, and waste management practices challenges and attitude. Studies that have been done in the past have demonstrated that public health medical waste management infrastructure was under prioritized in a number of settings in Africa and developing countries. To change the status quo, government have a key role in strengthening and building trans-disciplinary teams of health sector human resource base with a transformative-leadership abilities responsible enough to safeguarding their own health and the promoting population wide health of their communities (WHO 2015).

## 5.0 CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

Infectious waste management in general hospitals in Lusaka, Zambia was investigated nesting the perspectives of healthcare workers. Health workers acknowledged that while they were primary producers of infectious waste, their attitude towards waste management was negative. Most health workers did not take full responsibility when it came to waste disposal transportation, and segregation contrary to the policy requirements.

Across the study area, the waste management recommendations, policies and guidelines on proper handling and management are still substantially undermined by a myriad interlinked factors such as inadequate knowledge levels, health workers attitude and practices towards infectious waste management, low policy compliance levels of healthcare facility towards infectious waste. On the other hand, health system factors included limited space for storing waste before disposal or transportation and the lack of awareness about segregation and waste management rules as well as the limited financial resource to procure standard infectious waste protection and disposal

equipment. Others observed included, inadequate management of infectious waste mainly due to inadequate waste collection vessels such as bin liners and bins lack, shortage of manpower and above all the improper management of waste in the health care sector.

In the wake of emerging global pandemic management of infectious medical waste should be on high alert as the only sure way of controlling its corresponding risks on health and to prevent the transmission of infectious such as hepatitis, AIDS, and typhoid including the Covid-19 pandemic which has led to increases in patient and healthcare activities and increased the waste generation and the proportion of infectious waste in the.

### 5.2 Recommendations

- There is need to conduct longitudinal studies across hospitals to establish the impact of waste management practices and its corresponding health risks
- The government should effectively fund hospitals to enable them train health workers, procure adequate infectious waste management equipment among others in case of delayed supplies from or the central supply chain.
- There is need to for the Zambian government to sub contract the private sector or social entrepreneurs to management waste on behalf of hospitals to address the current challenges facing the General hospitals while seeking for sustainable long-term solutions.
- There is need to increase the operational capacity of ZEMA to enhance effective monitoring of Health Care Institutions over Health Care Wastes compliance and surveillances.

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