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Proposed Solutions to Address the Challenges of Medical Waste Management in Health Facilities in Kamukunji Sub-County, Nairobi City County, Kenya

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Abstract

Medical waste management in Kenya has been greatly affected by the country's elevated production levels. The majority of medical facilities do not have an extensive medical waste management system, or if they do, they do not handle waste thoroughly, and therefore is detrimental to humans and the environment. This research focuses on health facilities' management of medical waste in Kamukunji sub-county, assessing the specific problems of medical waste management in that area. This was a study focusing on healthcare workers, their working conditions and habits. This study was an analytical cross-sectional study design. Multistage sampling methods for the selection of 10 health facilities and 141 study participants. The R square was 0.746, indicating that medical waste management was harmed by a lack of funding, insufficient logistics, a lack of disposal sites, and a lack of understanding. This demonstrated a 74.6 percent variance in healthcare waste management due to a lack of funding, insufficient logistical supply, a lack of disposal site, and a lack of awareness. The remaining 25.4% implies that there were additional issues affecting the healthcare waste management systems of the ten health facilities evaluated. By explicitly identifying a given color with a certain category and its accompanying hazard, segregation aids to make waste processing safer. During the research period, Pumwani Maternity Hospital generated the most medical waste (80Kg) and Bahati Health Center generated the least (15Kg). The study concludes that periodic updates in medical waste management are necessary, as is refresher training for healthcare professionals and waste handlers. Additionally, it is advised that each health care facility have a safe and hygienic system in place for the handling, segregation, c collection, storage, transportation, treatment, and disposal of medical waste. All health facilities in Kenya, the study states, should adhere to the National Policy on Injection Safety and Medical Waste Management (2007). The 2007 strategy aims to emphasize the need of advocating for both the support and execution necessary to adequately manage healthcare waste.

Keywords: *Medical waste generation, health risks, medical waste management solutions, challenges of medical waste management, health facilities*

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1.0 Introduction

Medical waste is composed of waste from healthcare and medical procedures, like needles, sharp objects, tissues, bodily fluids, medications, and more (WHO, 2017). Medical waste includes all waste produced by the following actions: diagnosing, producing or testing biologically, obtaining sufficient waste from households, and removing waste regulated under trauma waste management by practitioners in trauma waste management (ICRC, 2019). It is challenging to deal with waste because of the impact it has on the environment and public health. While dealing with residential, commercial, municipal, agricultural, and construction and demolition waste is fine, there are no exceptions to dealing with solid and liquid waste, and in this regard, health waste needs to be treated with more severity (Abor & Bouwer, 2018).

Global health risks exist due to the potential hazard in the disposal of medical waste (WHO, 2017). Failure to safely dispose contaminated needles and syringes can expose staff and the public to various severe health problems. In places where sanitation is difficult, people can gather equipment that has been contaminated and either make it usable again or sell it. Infections with diseases caused by contaminated needles such as Hepatitis B, C, and HIV spread rapidly: by 2000, the WHO found 21 million hepatitis B (32% of all new infections) virus infections; 2 million hepatitis C (40% of all new infections) virus infections; and 260,000 HIV infections (5% of all new infections) resulting from contaminated needles (WHO, 2017). In addition to the potential health risks and pollution of the surrounding environment, medical waste poses a risk to water quality, potentially infecting others with disease through water supply (Gao et al., 2015).

The average waste generation in hospitals, Kumarasamy & Jeevaratnam, (2017), was 0,934 kg/lb/Day; the percentage of non-hazardous waste produced in hospitals was 77.08%; and hazardous waste was 22,92%, which contributed to 32,1% of infections. An Irbid survey showed health-related waste generation rats in three hospitals at Princess Basma Hospital 6.904 kg/pat/day (4.315 kg/bed/day) 5.718 kg/pat/day (3.212 kg/bed/day) and 4.532 kg/pat/day (2,556 kg/bed/day) at Ibn Al-Nafis Hospital and, combined, contributed to 24.6 percent waste-management infections. A study carried out in Nigeria and South Africa has shown that Nigeria faces the problem of maladministration of hospital waste as the rest of the world. Recently, the management of hospital waste poses more problems with the introduction of disposables such as needles, syringes and similar items (Lakshmi, 2012). Studies in South Africa show that larger hospitals generate approximately 2kg per bed of waste where 0.5kgs are regarded as risky. This produces around 250,000 tons of hospital waste per year from all sorts of Nigeria and South Africa healthcare facilities, which has bad environmental effects and pollutes the land, air and water resources (Nagaraju, et al., 2013).

In Tanzania, some public health establishments face a broad range of challenges in managing waste produced by them, covering financial, technical and administrative issues. Biomedical waste management financing at those facilities is extremely poor, leading to dubious treatment of medical waste generated in these facilities. Without making significant investments in low-level health facilities, like health centers and dispensaries, higher-level medical institutions have managed to become adept at managing medical waste. All these problems require an examination of the current situation in the LLHFs (Banu et al., 2015; Emilia et al., 2015).

Al-Emad (2016) asserts that the toxic nature of hospital waste poses grave concerns to environmental health. Due to Kenya's inadequate waste segregation methods, up to 50% of

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garbage is discovered to be infectious in some medical institutions. Kenya's hospital waste management systems face huge hurdles. Patients face grave everyday threats as a result of indiscriminate trash disposal (MoH, 2015). Medical waste is becoming an increasing concern in Kenya. Historically, inappropriate medical waste disposal has been a non-issue for the general public, and the magnitude of this has had a detrimental effect on both poor and distracted members of society. The purpose of this research is to determine the factors affecting the health care waste management system at Nairobi County, Kenya.

Inadequate management of medical waste can pollute air, soil and water sources, causing serious health consequences for human, animal and other living beings. The infectious and hazardous nature of health waste requires care and tact for the management or handling of waste (Yawson, 2016). People working in the medical field and the general public can be affected by the effects of poor handling of medical waste. This includes medical staff, from nurses to doctors, along with their patients and waste scavengers. There are a number of parasites, which can be acquired by waste handlers, people living near trash dumps, and those who suffer from cholera, yellow fever, and salmonellosis. These people are found to be carrying gastrointestinal parasites (Kuchibanda & Mayo, 2015).

Despite having been created to ensure the health of its patients, the healthcare system in fact causes illness and disease by spreading infections and contamination. Medical facilities create a wide variety of infectious and/or hazardous medical waste that, if not handled in a meticulous and well-thought-out manner, can cause serious health problems for patients, health care workers, those collecting the waste, and the community. Given the foregoing, the study aims to identify the challenges to manage medical waste in healthcare facilities in the County of Nairobi.

1.1 Problem Statement

Worldwide, governments are constantly on the lookout for solutions and alternatives that will help them improve their health standards. By establishing various public or private healthcare institutions, a way of improving standards can be achieved. However, in these health institutions, different health activities lead to huge amounts of health care waste (Mwania, 2019). Hospitals are health facilities that provide patients with preventive, curative and rehabilitative care (Hassan et al., 2018). One of the major environmental concerns is the management of hospital waste, which can significantly increase exposure to infectious pollutants. Hospital wastes have increased largely as medical activity has progressed rapidly and hospitals use relatively more disposable products (Makori, 2018).

The majority of health centers in Kenya, ranging from 18 percent to 64 percent, use ineffective waste treatment and disposal technologies, and excess water flowing from medical facilities sometimes gets into the public sewers unaltered before it gets treated, leading to a rash of disease outbreaks in the general population who drink this water. Among Kenya's most common challenges, the lack of awareness of, and education for health workers, the absence of storage and disposal facilities and other untreated devices are the unsuitable separation of infectious waste from general waste. Medical waste management poses health risks for communities in the Kamukunji sub-county. In this sub-county, health facilities face problems with poor funding, as they affect their waste management activities, which lead to public health problems. The test for 12 hospital waste management experts found relatively high rates of hepatitis B, pulmonary tuberculosis and enteric pathogens commonly associated with health care waste, multidrug-resistant bacterial organisms such as staphylococcus aureus (MRSA) resistant methicillin, and

extensive-spectrum beta-lactamase organisms (ESBL) and Pseudomonas aeruginosa. Therefore, a study on the challenges of medical waste management among health facilities in Kamukunji district was needed.

1.2 Research Objectives

i. To assess the perceptions of staffs towards solutions to address the challenges of medical waste management in health facilities in Kamukunji sub-county.
ii. To determine the level of medical waste generation among health facilities in Kamukunji sub-county.
iii. To determine the health risks of medical waste management in health facilities in Kamukunji sub-county in Nairobi City County.
iv. To identify medical waste management solutions to address the challenges in health facilities in Kamukunji sub-county in Nairobi City County.

2.0 Empirical Review

2.1 An Overview of Medical waste

Non-infectious medical waste is any kind of solid waste generated by medical diagnoses, treatments, or immunizations and includes medical waste generated by the production, research, or testing of biological specimens, including blood and blood products (Awodele et al., 2016). Medical waste like trash from hospitals' non-infectious cleanup activities are dumped in landfills while infectious medical waste goes to incinerators (Al-Khatib, 2014).

Medical waste can be defined as any debris which contains infectious agents or viruses. That can include things like tissue and organ cultures, infectious virus stock, pathological waste, human blood and blood products, which have been discarded, are no longer fit for consumption. Other discarded items include contaminated medical instruments, infected animal carcasses, and waste from medical, pathological, surgical, or pharmaceutical laboratories. Other medical waste includes things like these: (Guerrero et al., 2013; Hassan et al., 2018).

Because medical waste handling is a potentially hazardous activity, it requires specialized training that is tailored to the nature of hospital work, the hazards and risks to which employees may be exposed, and the responsibilities of individual employees (Njue et al., 2015). Although poor hazardous medical waste management is a problem in Kenya, it is a problem throughout the world, not only in Africa, but also in developing countries everywhere (Mugo, 2017). Nearly all injuries from sharps (such as needles and blades) result in a rise in infections in medical workers, hospital patients, and waste handlers and scavengers. Because of this, the need to treat medical waste at healthcare facilities has greatly increased (Hasan and Rahman 2018).

2.2 Waste management mechanisms employed by public health facilities

Most Kenyan hospitals are split on their categories of waste in regards to healthcare, as there are usually three major types (MoH, 2015). One of the most frequent waste management practices is using three bins to sort waste into the following categories: health conditions that are contagious or harmful general and puncture-proof containers filled with puncture-safe boxes to prevent waste spillage.

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2.3 Challenges facing medical waste management among public health facilities

Medical waste is a danger to the public and the environment if it is not properly handled. It is vital for anyone who is involved in the administration of the substance to comprehend its importance when handled correctly. Although healthcare workers involved in management tend to have gaps in knowledge, attitude, and practice, and thus often risk the public's health and the environment through pollution (Makori, 2018). A lack of knowledge about medical waste management is an obvious mistake; this can affect the practice of safe waste disposal and should not be ignored (Odonkor & Mahami, 2020).

Healthcare services, driven by the goals of eliminating risks, treating the sick, and dealing with health problems, all generate waste, which could pose dangers to human health. When waste created by health care activities is concerned, its potential to cause infection and injury is higher than that of other types of waste. This makes healthcare waste the most dangerous. The mishandling of healthcare waste could have negative health impacts, with catastrophic consequences, and may also have severe effects on the environment (Saat et al., 2015). Interest in handling healthcare waste (HCW) sustainably has been growing due to public fears of the adverse health effects that could result from exposure to possibly hazardous waste that patients produce during medical treatment (Ali & Kuroiwa, 2018). There is a huge difference in how Sub-Saharan African countries handle healthcare waste management, and this difference is particularly significant (Emilia et al., 2015).

Many countries around the world fail to think about the amount and type of healthcare waste that is generated in addition to environmental concerns related to healthcare waste management such as the management of waste through waste separation and recycling. Even though it may cause severe health consequences, it happens despite proper handling of HCW (Muduli & Barve, 2015). The Emilia (2015) team discovered that each year, approximately 8 million to 16 million new cases of Hepatitis B virus (HBV), 2.3 million to 4.7 million new cases of Hepatitis C virus (HCV), and 80,000 to 160,000 new cases of human immunodeficiency virus (HIV) are reported due to insufficient waste management systems (HIV).

No one should be surprised that in poor countries, where the various issues of healthcare compete for scarce resources, issues of waste management in healthcare have received less attention and don't get the prioritization they deserve. In healthcare management, the lack of good information on the critical aspect of healthcare waste management, as well as limited and narrow research on the public health consequences of its failure, makes it difficult to make informed decisions (Gao et al., 2015).

It has been a challenge for many years in developing countries to manage healthcare waste management and keep track of the quantities and compositions of waste generated. Healthcare waste is thought to be dumped openly in dumps and the environment in the hundreds of tons. This is often done alongside regular trash and hazardous waste (Giacchetta & Marchetti, 2016). Others have noticed a complete lack of health care workers (HCW) infrastructure, which they say is contributing to avoidable patient deaths (Yawson, 2016). Methods of waste assessment and quantification have been numerous in different parts of the world. A multitude of methods are available, ranging from field observations, to administration of questionnaires, to quantification (Giacchetta & Marchetti, 2016). Other methods include the use of checklists,

public and private records, and other relevant information (Mansab, 2015).

The information indicates that there's little variation in how various medical facilities manage their waste. (See the following figure) (Eslami et al., 2014). Waste minimization and reduction strategies were clearly absent at two different general hospitals, as described in the findings of a study by Awodele et al. (2016), who published their results regarding how the waste data and healthcare worker management practices of the two hospitals matched up (Borowy, 2020). If patients and the environment aren't protected from improper healthcare waste management, which compromises the air, water, and soil, people will be exposed to environmental risks. Health care facilities and hospitals have the obligation to provide citizens with good health. Even though healthcare wastes can present a greater risk than the diseases that were originally present, proper management is critical to minimizing the risk (Khan et al., 2019).

Before using any of these techniques, medical institutions must understand and study the issue and make a strategic plan, which takes into account local circumstances and is financially and logistically sustainable. It is essential to protect the health and environment from harmful waste such as medical waste by following all feasible procedures. It would be nice if we could get rid of all dangerous trash completely. Environmentally friendly waste management is defined by stricter control over waste storage, transportation, treatment, recycling, recovery, and disposal (ICRC, 2019).

Even though the World Health Organization says that if medical waste is properly sorted and managed, it rarely becomes excessive (2017). The overwhelming majority of healthcare waste can be disposed of as regular municipal solid waste, excluding a few items like dangerous medical needles, pathological waste, and infectious waste (which need special handling), as well as a small percentage of potentially hazardous chemical, biological, and pharmaceutical waste that has to be stored in specially designed containers (ICRC, 2019). The lack of rules or regulations concerning waste pick-up from hospital wards, treatment, handling, and disposal is a huge problem that must be addressed. These problems include inadequate training of personnel, who are inadequately equipped and lack waste management plans. This neglect of hospital waste causes it to be mixed with municipal trash, which only compounds the problem (Kumarasamy & Jeevaratnam, 2017).

It is hard to think of anywhere more serious than Africa with regard to medical waste management. You could name South Africa, Mozambique, Swaziland, Kenya, and Tanzania (Emilia et al., 2015; Kuchibanda & Mayo, 2015; Mugo, 2017). Poverty is identified as the primary reason for the lack of success in most African countries' efforts to handle hazardous waste in a sustainable manner. Additionally, the low temperatures (under 200 degrees Celsius) used in the medical waste incinerators results in the release of large amounts of dangerous byproducts such as HCl, CO, dioxins, and furans. The emissions from these incinerators are a hazard to the communities because these facilities (in hospitals) are located close to communities (Kuchibanda & Mayo, 2015).

If not handled properly, treatment of the HCW (including burning) could result in a significant pollution threat to the environment and air, with the release of mercury, dioxins, and furans. The safe management of health-care workers is critical in protecting the health of both the patients and the doctors working in a hospital, as well as protecting the general public (MoH, 2015).

Researchers working for the Japan International Cooperation Agency (JICA) and the Kenya Expanded Programme on Immunization (KEPI) discovered that in most medical facilities, health care waste management (HCWM) standards are not being met, which increases the risk of disease and injury for both patients and workers (MoH, 2015).

2.4 Health risks posed by medical wastes

The improper disposal of medical waste in healthcare establishments increases the risk of child, adult, and animal contact with these wastes, resulting in serious health consequences. This unsuccessful waste may also harm medical staff, which also pose a job hazard within the health care facility. Hospital-associated (HAI) infections affect about 5% of patients receiving hospitals according to the World Health Organization (2017). Because of this, resources that would otherwise be allocated to other patients are diverted away from this critical task.

The improper disposal of medical waste in the environment has a variety of negative consequences as well as positive consequences (WHO, 2017). Chemical pollutants from medical waste (for example, heavy metals) cause inconvenience in the surrounding area, and their accumulation in soil may have an impact on the plants in the compound, resulting in a distorting of the hospital's landscape. The clinic would be forced to find a more expensive water source due to the water becoming more contaminated as a result of groundwater contamination (WHO, 2019). Unsanitary dumping of garbage is a major source of dangerous pollutants which pollute equipment and spread infection to humans and animals (Khalaf, 2019).

Open dump sites are unsightly and can scare patients away, which will damage the hospital's reputation. Rather than focusing on developing new ways to recycle and reuse waste, medical waste management should prioritize education on the proper disposal of waste to the relevant healthcare administrators (WHO, 2017). People in the healthcare field, including healthcare workers, waste handlers, haulers, and general public members, face possible occupational and public health risks if management of healthcare waste at institutions like hospitals, clinics, and other facilities is poor. Human lives could be threatened by pollution which affects air, water, and soil, in addition to wildlife (ICRC, 2019). The community members may be able to collect used medical equipment, which if not properly disposed of, can potentially spread disease. Healthcare waste issues have gotten more complicated, with increased incidence of HIV, SARS, and Hepatitis B. The risk of cross-contamination when handling and disposing of such waste has greatly increased (UNEP, 2020).

Infectious diseases can be spread when human blood, used for injections and blood testing, comes into contact with wounds caused by contaminated needles and syringes. After getting straight to the consequences for human health, focus should be on the environmental risks like pollution to water, air, and soil (UNEP, 2020).

Upon reviewing the literature, it is clear that a significant amount of knowledge is lacking, and it is this gap that this study seeks to close. a) Background information As Hassan et al. (2018) have found in some studies that doctors, nurses, and laboratory technicians have better knowledge about medical waste management, they also acknowledge that there is still a gap in practice when it comes to medical waste management. Nurses and laboratory staff, as opposed to doctors, may have a better understanding of color coding and waste segregation at the source, as an example. All of the sanitary staff members are clueless when it comes to practices related to medical waste management. There is sometimes no correlation between the level of knowledge and the level of practice in medical waste disposal at the global, regional, and local levels.

Therefore, on the basis of the findings from Kamukunji, this study seeks to fill in the gaps in knowledge regarding medical waste management challenges.

3.0 Research Methodology

This study was an analytical cross-sectional study design that used Fischer et al., (1997) formula for sample size determination. Multistage sampling methods for the selection of 10 health facilities and 141 study participants. Before the actual data collection, the questionnaires were pre-tested in one of the public health facilities in Starehe Constituency (Casino Health Centre) which was not sampled in the main study. The relationship between dependent and independent variables in this situation was determined with the help of correlation analysis. To estimate the strength of the connection between separate variables and dependent variable, the combination of odds ratio (OR) and 95% confidence interval (CI) was used. The statistical significance of the 0.05 level for each study was determined and the results were reported as a two-sided p value with 95 percent trust intervals (CI) for each study.

A multivariate analysis was carried out after a bivariate analysis has been completed, and all independent variables that were found to be significantly associated during the bivariate analysis were taken into account together in the multivariate analysis. This was accomplished through the application of binary logistic theory and practice. When estimating the strength of association between a retained independent variable and a dependent variable under consideration, the adjusted odds ratios (AORs) and their respective 95 percent confidence intervals (CIs) was used. Qualitative data collected from participants using an observational checklist was cleaned and coded manually based on themes developed from their responses (thematic analysis), and the results were reported in narrative form, with quantitative data being used to supplement and reinforce the findings. Various representations of the findings were presented including tables, bar charts, graphs, and pie charts.

4.0 Results and Discussion

4.1 Healthcare Waste Generation

4.1.1 Availability of Waste Storage Receptacle

All the health facility had medical waste storage receptacle with most of facilities (90.1%) had safety boxes and 73.8% use pedal bins to store the medical waste you generate

Table 1: Availability of Waste Storage Receptacle

Characteristics	Frequency	Percent
Safety boxes	127	90.1%
Pedal bins	60	42.6%
Standard dust bins	104	73.8%
Improvised receptacle	15	10.6%
Bucket	23	16.3%

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As illustrated in Table 1, on observation it was found that most (60%) of health facility had filled up safety boxes and standard dustbins, sixty percent of respondents reported that their health institution had distinct containers (bins) for different types of garbage. Similarly, 70% of respondents said that hazardous waste generated by health care was segregated prior to treatment and disposal in their healthcare facilities. Additionally, 50.0 percent of respondents reported that healthcare waste was processed prior to being disposed of in their facility. Additionally, it was determined that 60% of respondents reported that their facility clearly indicates the path for waste management from segregation to final disposal. The findings indicated that among the other elements influencing the healthcare waste management system at the ten selected health institutions in Kamukunji Sub County, distinct containers (Bins) for various types of garbage received the highest mean score. The findings corroborate Kuchibanda and Mayo's (2015) claim that segregation of healthcare waste should begin at the point of creation and should be disposed of in accordance with applicable legislation and classifications.

4.1.2 Quantity of Daily Waste Production

Most of health facilities (39.0%) had daily medical waste weighing less than 26kg with 34.8% and 12.1% weighing between 26-50 kg and 46-100 kg respectively.

Table 2: Quantity of Daily Waste Production

Quantity	Frequency	Percent
0-25kg	55	39.0%
26-50kg	49	34.8%
51-75kg	20	14.2%
76-100kg	17	12.1%

On observation, the quantity of health facility waste generated at the various hospitals ranged from approximately 15 Kg to approximately 80 Kg. Pumwani Maternity Hospital generated the highest quantity of medical waste (80Kg), followed St Teresa's Parish Health Centre (50 Kg), Makkah Nursing Home (45 Kg) and the least from Bahati Health Center (15 Kg) during the study period.

4.1.3 Storage of Receptacle for Medical Waste

Majority of health facilities (88.7%) store medical waste receptacles inside a health facility.

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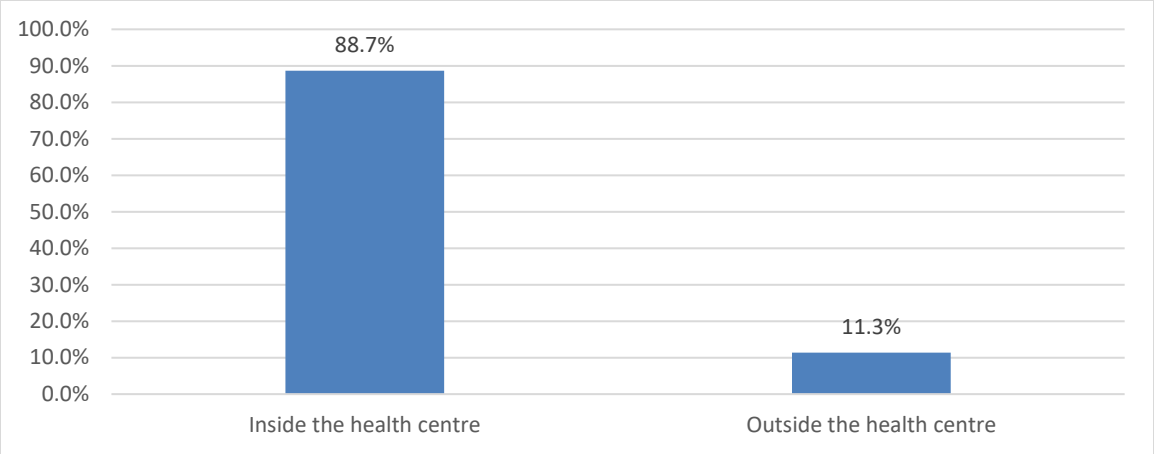

Figure 1: Storage of Receptacle for Medical Waste

On observation, over half of the health institutions said that there are frequently inadequate trash containers to handle the volume of healthcare waste generated. Only about a quarter of health institutions surveyed have some form of medical waste separation at the site of creation, and there are no designated carts or routes for trash transportation. The majority of health institutions lack waste storage areas. Over 80% of establishments in the Kamukunji sub county lack secure storage for medical waste. The garbage bags are heaped in the restrooms and even in the kitchens, which is unsightly and poses a significant hygiene hazard. Additionally, the data indicated that garbage, with the exception of sharps, is not segregated. Two-thirds of health care institutions have safe sharps containers (sometimes plastic bottles). Only about half separate other categories of garbage, such as waste generated in operating rooms and laboratories, which includes infectious and pathological waste.

4.1.4 Identification Method for Different Types of Medical Waste

Majority of respondents (95.7%) use color to identify different types of medical waste with slightly less than half (49.6%) using labelling (Figure 2).

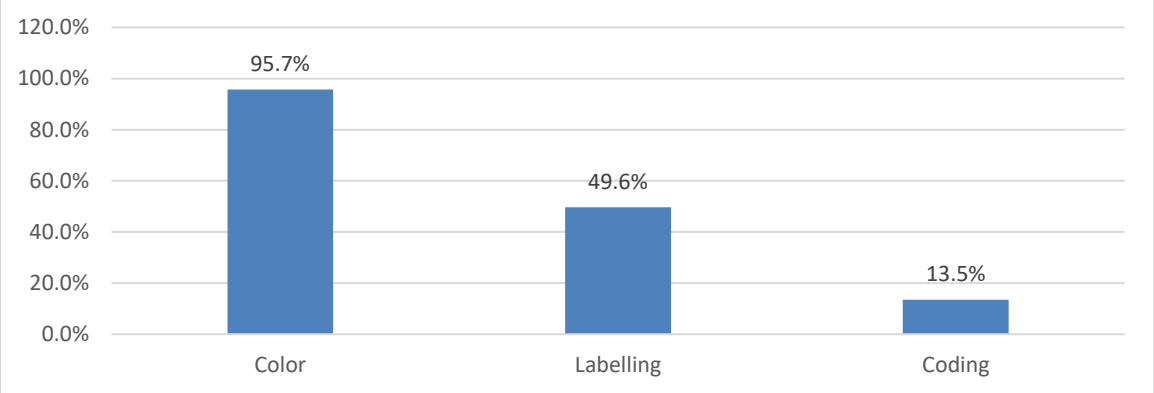

Figure 2: Identification Method for Different Types of Medical Waste

The researcher sought to ascertain respondents' perceptions on the various types of healthcare waste separated in their health facility. When it came to separating their rubbish into receptacles, respondents said that they separated their waste into general waste, infectious waste, and extremely infectious waste. Emilia et al. (2015) conducted a study in Ghana and observed that

both public and private hospitals divided their trash into various groups by first determining the kind of waste and then separating non-infectious or general waste from infected waste.

The researcher wanted to ascertain respondents' perceptions on healthcare waste containers used in healthcare facilities. The respondents responded that their health institution mostly used color-coded bins, sharps containers, improvised local containers, and safety boxes. These findings are corroborated by Kumarasamy and Jeevaratnam (2017), who stated that the use of color coding and marking enables easy segregation and identification of various waste categories. Thus, segregation leads to safer waste management by explicitly identifying a certain color with a particular category and its related danger.

Only 40% of facilities utilize color coding (for infectious waste, they used yellow or red bags). One-third of hospitals lack enough on-site storage containers. All healthcare trash is frequently mixed with ordinary rubbish in open buckets lined with extremely thin plastic bags. The bags are insufficiently sturdy and, in many cases, readily perforated, allowing for leakage and spilling. Containers are not labeled, and there is no way to distinguish between garbage generated in kitchens and waste generated in labs.

4.1.5 Disposal of Healthcare Waste

Most of health facilities (90.8%) had given a contractor to dispose some medical waste with 36.2% and 15.6% of wastes are incinerated and burning respectively (Table 3).

Table 3: Disposal of Healthcare Waste

Disposal of healthcare waste	Frequency	Percent
Incineration	51	36.2%
Crude burning	22	15.6%
Given to a contractor to dispose	128	90.8%

The researcher wanted to ascertain respondents' perceptions on waste treatment technology utilized by healthcare facilities. The respondents responded that their Healthcare Facility mostly used open burning, burning chambers, composite pits, placenta pits, and incineration. The findings are comparable to those of Njue et al., (2015), who discovered that health centers had dug trenches. Additionally, the study discovered that the majority of potentially toxic compounds identified in the vicinity of health center burners were emitted during combustion, and the leftover ash included a high concentration of metallic contaminants.

Participants were asked about the challenges they've had when trying to use medical waste equipment in a hospital setting. Most of the respondents said they were at risk of infection because their healthcare facility did not provide them with adequate bin liners or ongoing medical education on how to properly handle healthcare waste equipment. They also said that some of the waste equipment was not weatherproof, making it difficult to work in bad weather conditions. WHO (2017) confirmed the findings, noting that the most frequently encountered problems with healthcare waste include a lack of awareness of the health hazards associated with HCW materials, a lack of education on proper waste management techniques, a lack of waste disposal systems, a lack of human and financial resources, and finally, a lack of priority given to the topic of healthcare waste.

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Researchers also wanted to know how respondents felt about the ultimate waste disposal techniques used by health care facilities. Respondents stated that the majority of their healthcare facilities used deep pit burials and open-burning as their preferred methods of burial. Medical waste in Kenyan hospitals is being burned in the open without any safeguards, according to Njue et al., (2015), who claim that the release of dioxins, furans and heavy metals that cause cancer in humans and kill ecosystem life has had a negative impact on the health of local residents who live near healthcare facilities.

4.1.6 Distance to Disposal Site from the Health Centre

More than half of health facilities (52.5%) had disposal site above 400 metres from the facility.

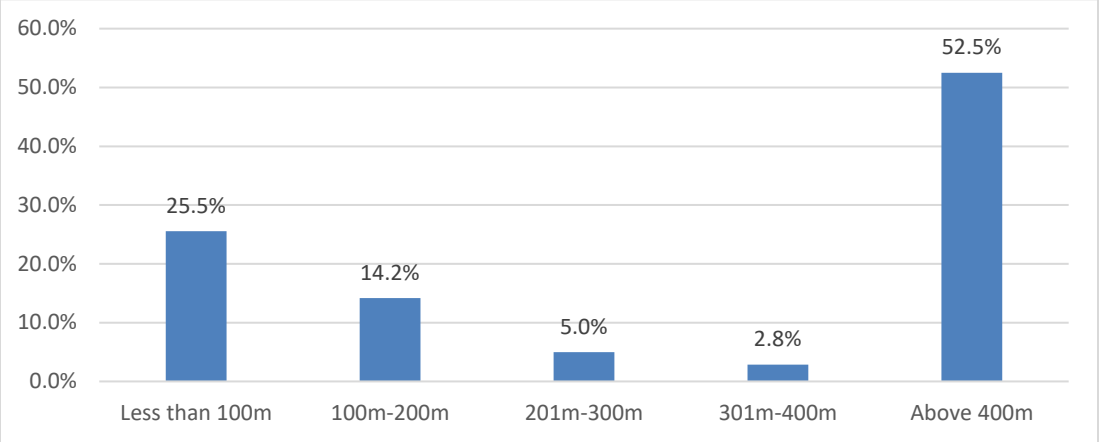

Figure 3: Distance to Disposal Site from the Health Centre

4.1.7 Availability of Manual/Guidelines on Healthcare Waste Management

Slightly less than three quarter (71.6%) of respondents had manual/guidelines on health care waste management in the facility.

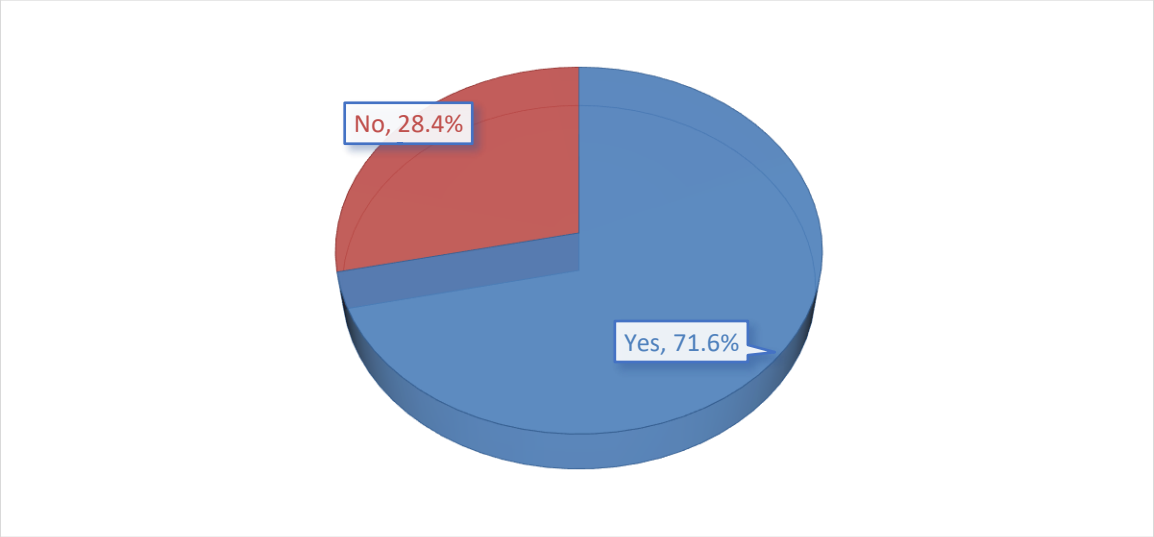

Figure 4: Availability of Manual/Guidelines on Healthcare Waste Management

4.2 Factors Affecting Waste Management

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4.2.1 Various Factors Affecting Waste Management

Lack of funds (76.4%), and lack of disposal site (73.6%) were common factors affecting waste management (Table 4).

Table 4: Various Factors Affecting Waste Management

Factors	Frequency	Percent
Lack of funds	107	76.4%
Poor logistics supply	70	50.0%
Lack of disposal site	103	73.6%
Lack of knowledge	77	55.0%

4.2.2 Correlational Analysis

When the traits are completely unrelated to one another, the coefficient of association is now equal to zero. As previously stated, statistical significance is defined as a probability (p) less than 0.01 ($p<0.01$). When the probability is more than 0.01 ($p>0.01$), the link is considered non-significant statistically. Pearson correlation coefficient (r) analysis was used to determine the correlation between the variables of interest in this study. Correlation The coefficient determines the degree of interdependence between the four predictor variables and the relationship between the predictor variable and the response variable (healthcare waste management system) at a 95% confidence range. The results of Table 5 demonstrate the significance of the association between a lack of cash, a deficient logistical supply, a lack of disposal space, and a lack of expertise among health institutions in Kamukunji Sub County. The findings indicated that while there is no statistically significant association between inadequate logistical supply and a lack of finance, there is a weaker positive relationship ($r = 0.134$, $p =0.089$). However, there was a statistically significant and stronger positive relationship between a lack of disposal site and a lack of funding ($r = 0.562$, $p=0.003$), as well as a statistically significant and stronger positive relationship between a lack of disposal site and a lack of logistic supply ($r = 0.329$, $p = 0.011$). Additionally, a statistically significant and stronger positive link was discovered between lack of knowledge and a lack of funds ($r = 317$, $p=0.024$), a lack of disposal sites ($r = 0.384$, $p = 0.008$), and a lack of logistic supply ($r = 0.377$, $p = 0.019$). All predictor factors demonstrated a positive connection with the response variable, suggesting that they may all be used to describe the healthcare waste management system in Kamukunji Sub County.

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Table 3: Correlational Analysis

		Lack of funds	Poor logistics supply	Lack of disposal site	Lack of knowledge
Lack of funds	r	1			
	Sig. (2-tailed)				
Poor logistics supply	r	0.134	1		
	Sig. (2-tailed)	0.089			
Lack of disposal site	r	0.562*	0.329*	1	
	Sig. (2-tailed)	**0.003**	**0.011**		
Lack of knowledge	r	0.317*	0.377*	0.384*	1
	Sig. (2-tailed)	**0.024**	**0.019**	**0.008**	

4.2.3 Multiple Regression Analysis

According to the regression summary results in Table 6, the R Square value is 0.746, indicating that medical waste management was harmed by a lack of funding, a deficient logistical supply, a lack of disposal space, and a lack of understanding. This demonstrated a 74.6 percent variance in healthcare waste management due to a lack of funding, insufficient logistical supply, a lack of disposal site, and a lack of awareness. The remaining 25.4 percent suggests that there were additional elements affecting the healthcare waste management systems of the ten health institutions in Kamukunji Sub County that were not examined in this study.

Table 4: Multiple Regression Analysis

Model	R	R square	Adjusted R square	Std. Error of the estimate
1	0.864a	0.746	0.662	0.163

a. Predictor: (Constant), lack of funds, poor logistics supply, lack of disposal site, and lack of knowledge

4.3 Health Risks of Medical Waste Management

4.3.1 Problems of Medical Waste at the Community

Majority of respondents (87.2%) did not associate medical wastes with various problems with 12.8% associated medical waste with accidents (55.6%), diseases (27.8%), and drainage blockages (27.8%) as presented in table 7.

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Table 5: Problems of Medical Waste at the Community

Characteristics		Frequency	Percent
Medical waste problems	Yes	18	12.8%
	No	123	87.2%
Problems	Diseases	5	27.8%
	Accidents	10	55.6%
	Land pollution	7	38.9%
	Drainage blockages	5	27.8%

4.3.2 Health Risks Associated to Medical Waste at the Facility

Almost 11% of respondents associated health risks to medical waste at the facility such as diseases (80.0%), sharps-inflicted injuries (80.0%), and pollution (53.3%) as presented in table 8.

Table 6: Health Risks Associated to Medical Waste at the Facility

Characteristics		Frequency	Percent
Health risks associated to medical waste	Yes	15	10.6%
	No	126	89.4%
Specific health risks	Diseases	12	80.0%
	Pollution	8	53.3%
	Sharps-inflicted injuries	12	80.0%

Concerning the risks associated with the management of healthcare waste and interventions, observations at Kamukunji sub county health facilities suggested that personnel were at risk of needle-stick injuries/pricks. However, danger was mitigated with the use of personal protective equipment (PPE). At Pumwani Maternity Hospital, the majority of healthcare professionals used suitable personal protective equipment. However, less than 30% of employees at Diani dispensary, Majengo dispensary, and Rapha Medical Clinic wore sufficient PPE during the research period, putting them at risk of nosocomial infections and needle-stick injuries/pricks.

4.3.3 Individual Health Risks Associated to Medical Waste

At least 6% had been affected by medical waste with 62.5% and 50.0% affected on physical injury and environmental pollution respectively.

Table 7: Individual Health Risks Associated to Medical Waste

Characteristics		Frequency	Percent
Affected by the medical wastes	Yes	8	5.7%
	No	133	94.3%
Individual health risks	Physical injury	5	62.5%
	My attitude was affected	1	12.5%
	The environment was polluted	4	50.0%

5.0 Conclusion

The study revealed that respondents mostly used color-coded bins, sharps containers, improvised local containers, and safety boxes. According to our observations, one-third of health institutions do not have enough onsite storage containers. By explicitly identifying a given color with a certain category and its accompanying hazard, segregation aids to safer waste processing. In buckets coated with very thin plastic bags, healthcare waste is mixed with ordinary rubbish. The bags are insufficiently tough and readily perforated, allowing for leakage and spilling. Containers are not labeled, and there is no way to distinguish between garbage generated in kitchens and waste generated in labs.

In this study, most of health facilities had daily medical waste weighing less than 26kg with 34.8% and 12.1% weighing between 26-50 kg and 46-100 kg respectively. On observation, during the research period, Pumwani Maternity Hospital created the most medical waste (80Kg) and Bahati Health Center generated the least (15Kg).

The study revealed that 87.2% of respondents did not associate medical wastes with various problems in the community. Almost 11% associated health risks to medical waste at the facility. At least 6% had been affected by medical waste with 62.5% and 50.0% on physical injury and environmental pollution.

The analysis discovered a statistically significant and greater positive association between a lack of disposal sites and a lack of funding; similarly, a statistically significant and larger positive relationship was discovered between a lack of disposal sites and a lack of logistic supply. Additionally, it was shown that a statistically significant and greater positive association existed between a lack of knowledge and a lack of funds, a lack of disposal sites, and a lack of logistical supplies.

6.0 Recommendations

It's also recommended in the study that all healthcare facilities in Kamukunji Sub County and all across the country receive proper management training on all elements of health workers' knowledge and practice. Health workers and waste handlers can be protected from exposure and accidents by identifying and filling in knowledge gaps among different types of healthcare employees. Refresher training for waste handlers and health care workers should also be provided following a critical review of existing waste management practices, including the stages of segregation; storage; collection; transportation; treatment; and disposal; as well as the development/adoption of guidelines and standard operating procedures.

There should be a requirement for every health care facility (HCF) to maintain an efficient, safe, and hygienic medical waste management system that is as low-risk for workers, the public's health, and our environment as possible. This can be done by coordinating with the relevant ministries and agencies within each HCF.

The study recommends that medical waste management policies be updated on a regular basis and that healthcare workers and waste handlers receive refresher training on medical waste management policies in health facilities in Kamukunji sub county and throughout Kenya because healthcare workers lack knowledge about HCW management principles and existing policies at healthcare facilities in Kamukunji sub county. A further recommendation is that all Kenyan health institutions adhere to the 2007 National Policy on Injection Safety and Medical Waste Management, which stresses the need of pushing for both the support and implementation of healthcare waste management in Kenya.

The following ideas have an impact on how the 2007 policy is implemented: Safer injection devices as well as sharp waste disposal procedures are used to reduce the danger to health care personnel, patients and communities as a whole, and to reinforce the essential human resources for the strategy to be effective.

REFERENCES

Abor, P. A., & Bouwer, A. (2018). Medical waste management practices in a Southern African hospital. *Journal of Applied Sciences and Environmental Management*, *21*(4), 356–364. https://doi.org/10.1108/09526860810880153

Al-Emad, A. A. (2016). Assessment of medical waste management in the main hospitals in Yemen. *Eastern Mediterranean Health Journal*, *17*(10), 730–737. https://doi.org/10.26719/2011.17.10.730

Al-Khatib, I. A. (2014). Problems of management of medical solid waste at primary health care centres in the Palestinian Territory and their remedial measures. *Eastern Mediterranean Health Journal*, *19*(6), 804–811. http://applications.emro.who.int/emhj/v19/Supp3/EMHJ_2013_19_Supp3_S152_S158.pdf?ua=1

Ali, M., & Kuroiwa, C. (2018). Status and challenges of hospital solid waste management: case studies from Thailand, Pakistan, and Mongolia. *Journal of Material Cycles and Waste Management*, *11*(3), 251–257. https://doi.org/10.1007/s10163-009-0238-4

Awodele, O., Adewoye, A. A., & Oparah, A. C. (2016). Assessment of medical waste management in seven hospitals in Lagos, Nigeria. *BMC Public Health*, *16*(1), 1–11. https://doi.org/10.1186/s12889-016-2916-1

Banu, A., Shamsundar, B. V, & Bharadwaj, M. S. (2015). Challenges Of Hospital Solid Waste Management; Case Study In Challenges Of Hospital Solid Waste Management; Case Study In A Tertiary Care Hospital. *International Journal of Current Research*, *29*(25), 592–599. https://doi.org/10.1177/0734242X13479429

Emilia, A. U., Julius, N. F., & Gabriel, G. (2015). Solid medical waste management in Africa. *African Journal of Environmental Science and Technology*, *9*(3), 244–254. https://doi.org/10.5897/ajest2014.1851

Eslami, A., Nowrouz, P., & Sheikholeslami, S. (2014). Status and Challenges of Medical Waste Management in Hospitals of Iran. *Civil Engineering Journal*, *3*(9), 741–748. https://doi.org/10.21859/cej-030910

Gao, C., Li, J., Liu, Z., & Xu, J. (2015). Avoidance behavior and acute toxicity of Eisenia fetida

under exposure to lead, cadmium and chromium in soil. *Research of Environmental Sciences*, *28*(10), 1596–1601. https://doi.org/10.13198/j.issn.1001-6929.2015.10.14

Giacchetta, G., & Marchetti, B. (2016). Medical waste management: a case study in a small size hospital of central Italy. *Medical Waste Management*, *6*(1), 65–84. https://doi.org/10.1108/17538291311316072

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

Hasan, M. M., & Rahman, M. H. (2018). Assessment of Healthcare Waste Management Paradigms and Its Suitable Treatment Alternative: A Case Study. *Journal of Environmental and Public Health*, *75*(11), 687–697. https://doi.org/10.1155/2018/6879751

Hassan, A., Tudor, T., & Vaccari, M. (2018). Healthcare Waste Management: A Case Study from Sudan. *Environments*, *5*(8), 89. https://doi.org/10.3390/environments5080089

ICRC. (2019). Medical waste management. *Journal of Environmental Management*, *599*(56), 1451–1475. https://doi.org/10.3399/bjgp09X421021

Khalaf, A.-S. A. (2019). Assessment of Medical Waste Management in Jenin District Hospitals. *Waste Management & Research*, *25*(9), 271–287. https://doi.org/10.1177/0734242X13479429

Khan, B. A., Cheng, L., Khan, A. A., & Ahmed, H. (2019). Healthcare waste management in Asian developing countries: A mini review. *Waste Management and Research*, *37*(9), 863–875. https://doi.org/10.1177/0734242X19857470

Kuchibanda, K., & Mayo, A. W. (2015). Public health risks from mismanagement of healthcare wastes in Shinyanga municipality health facilities, Tanzania. *Scientific World Journal*, *98*(11), 756–764. https://doi.org/10.1155/2015/981756

Kumarasamy, M., & Jeevaratnam, V. (2017). Review on Management of Hospital Waste in An Efficient Manner. *International Journal of Environmental and Agriculture Research*, *3*(8), 55–59. https://doi.org/10.25125/agriculture-journal-IJOEAR-JUL-2017-12

Lakshmi, S. & K. P. (2012). Awareness about Bio-Medical Waste Management among Health Care Personnel of Some Important Medical Centers in Agra. *International Journal of Environmental Science and Development*, *1*(3), 251–255. https://doi.org: 10.4103/0970-9290.87055

Makori, F. (2018). Challenges Facing Implementation Of Healthcare Waste Management Projects In Kenya. *Strategic Journal of Business & Change Management*, *5*(2), 132–139. https://doi.org/ 10.3934/strabizmanagement.2020028

Mansab, M. R. (2015). Sharps Waste Management At Kidongo - Chekundu National Mental Hospital - Zanzibar Tanzania. *African Journal of Environmental Science and Technology*, *29*(5), 255–263. https://doi.org/12.2015/AJEST.731734

MoH. (2015). Health Care Waste Management Strategic Plan 2015-2020. *Ministry of Health, Kenya*, *15*(3), 1–153. https://www.health.go.ke/wp-content/uploads/2016/01/HCWM-Strategic-Plan-2015-2020-.pdf

Muduli, K., & Barve, A. (2015). Challenges to Waste Management Practices in Indian Health Care Sector. *Journal of BMC Public Health*, *3*(1), 7–11. https://doi.org/10.4236/BMC.2013.49105

Mugenda, O. ., & Mugenda, A. G. (2003). Research methods: Quantitative and Qualitative approaches. Nairobi Acts Press. Kenya. *International Journal of Education and Research*, *18*(2), 386–396. https://doi.org/10.4236/psych.2003.115053

Mugo, L. N. (2017). Factors Influencing Waste Management In Public Hospitals In Nakuru County, Kenya. *East Africa Medical Journal*, *21*(10), 958–1014. https://doi.org/10:1177/0734232X20914748

Mwania, M. M. (2019). Assessment of Factors Affecting Healthcare Waste management System in Machakos County, Kenya. *International Journal of Medicine and Public Health*, *61*(9), 1925–1933. https://doi.org/10.4103/2230-8598.179755

Nagaraju, B, Padmavathi G.V, Puranik D.S, Shantharaj M.P, S. S. . (2013). Knowledge and practice on bio-medical waste management among the health care providers working in PHCs of Bagepalli Taluk. *International Journal of Medicine and Biomedical Research*, *2*(l), 28–35. https://doi.org/10.14194/ijmbr.216

Njue, P. M., Cheboi, K. S., & Oiye, S. (2015). Adherence to Healthcare Waste Management Guidelines among Nurses and Waste Handlers in Thika Sub-county- Kenya. *Ethiopian Journal of Health Sciences*, *25*(4), 295. https://doi.org/10.4314/ejhs.v25i4.2

Odonkor, S. T., & Mahami, T. (2020). Healthcare waste management in Ghanaian hospitals: Associated public health and environmental challenges. *Waste Management & Research*, *38*(8), 831–839. https://doi.org/10.1177/0734242X20914748

Saat, K., Dan, I. N. I., Ke, T., Dalam, D., & Limbah, P. (2015). Current Status and Future Challenges of Healthcare Waste Management in Indonesia. *Current Status and Future Challenges of Healthcare Waste Management in Indonesia*, *23*(2), 73–81. https://doi.org/10.22435/mpk.v23i2.3129.73-81

UNEP. (2020). Introduction to COVID-19 waste management. *United Nations Environment Programme*, *15*(5), 32–53. https://www.unep.org/resources/factsheet/covid-19-waste-management-factsheets

WHO. (2017). Preparation of national healthcare waste management plans in Sub-Saharan countries: Guidance manual. *World Health Organisation Library*, *141*(85), 898–969. http://www.who.int/water_sanitation_health/medicalwaste/en/guidancemanual.pdf

WHO. (2019). Safe management of wastes from health-care activities. *Geneva*, *54*(8), 1424–1502. https://apps.who.int/iris/bitstream/handle/10665/259491/WHO-FWC-WSH-17.05-eng.pdf;jsessionid=BE197A8BAB73EC864CA3573E15D4F0E6?sequence=1

Yawson, P. (2016). Assessment of Solid Waste Management In Healthcare Facilities In The Offinso Municipality. *Journal of the Indian Society of Hospital Waste Management*, *85*(1), 2071–2079. https://doi.org/10.1016/j.wasman.2016.10.023