ASSESSING THE KNOWLEDGE OF HEALTHCARE WORKERS ON DANGERS ASSOCIATED WITH MEDICAL WASTE MANAGEMENT IN EGOR LOCAL GOVERNMENT AREA

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NOVEMBER, 2025.

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A PROJECT SUBMITTED TO THE DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION, FACULTY OF EDUCATION, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE AWARD OF THE BACHELOR OF SCIENCE B.Sc (Ed), DEGREE IN ENVIRONMENTAL EDUCATION, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE.

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CERTIFICATION

We the undersigned, hereby certify that this work was carried out by Ndidiamaka OKOLONKWOR with the matriculation number EDU2102515 in the Department of Health, Safety and Environmental Education, Faculty of Education, University of Benin, Benin City, Edo State in partial fulfillment of the requirement for the award of Bachelor of Science (B.Sc. Ed) degree in Environmental Education.

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DR. (MRS) O. H. OBASUYI. **(Ag. Head of Department)**	**DATE**

DEDICATION

This project work is dedicated to Jehovah, whose constant support, love, grace, mercy, and kindness have sustained me through every challenge. I also dedicate it to my parents and siblings for their constant love and support.

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ABSTRACT

This study assessed the knowledge of healthcare workers on the dangers associated with medical waste management in Egor Local Government Area, Benin City, Edo State. The objectives were to determine healthcare workers' knowledge of the dangers of medical waste, safe handling and disposal procedures, waste management practices, the relationship between knowledge and practice, and the extent to which demographic variables influence knowledge levels. The study adopted the descriptive survey design. The population consisted of 205 healthcare workers, and a purposive sample of 144 respondents directly involved in medical waste handling was selected. Data were collected using a structured questionnaire validated by experts, and reliability was established using the split-half method with a Cronbach alpha coefficient of 0.742. Data were analyzed using frequency, percentage, mean, standard deviation, Pearson Product-Moment Correlation and chi-square.

Findings revealed that healthcare workers had high knowledge of the dangers associated with medical waste and substantial knowledge of safe handling and disposal procedures. Respondents also demonstrated strong understanding of waste management practices. A significant positive relationship was found between knowledge and waste management practices ($r = 0.684$, $p < 0.001$). The study concludes that knowledge plays a critical role in promoting safe waste management behaviors. It recommends continuous training, strict enforcement of waste management policies, adequate provision of PPE, and improved supervision in healthcare facilities.

CHAPTER ONE

INTRODUCTION

Background of the Study

Medical waste, also known as healthcare waste, comprises all forms of waste produced during the diagnosis, treatment, or immunization of humans or animals. This waste includes hazardous materials like infectious agents, toxic substances, sharps, and pharmaceuticals. On a global scale, medical waste presents serious public health and environmental concerns.

In recent years, the volume of healthcare waste has increased significantly worldwide, driven by expanded access to healthcare services, population growth, and the rising prevalence of chronic illnesses. The coronavirus pandemic further intensified this challenge, due to widespread use of personal protective equipment, test kits, and other disposable medical items. According to the World Health Organization (2022), approximately eighty-seven thousand tonnes of personal protective equipment waste were generated between March 2020 and late 2021, placing pressure on weak healthcare waste systems, especially in low-income countries.

Healthcare waste is generated in various facilities, with quantity and type varying based on services, care level, and local context. According to the World Health Organization (2024), approximately eighty-five percent of healthcare waste is non-hazardous and poses no significant risk under normal handling conditions. However, the remaining fifteen percent is considered hazardous and contains materials that are infectious, toxic, or

radioactive. If not managed properly, this hazardous fraction can cause serious harm to both human health and the environment. Mixing non-hazardous waste with hazardous waste results in contamination of the entire batch, emphasizing the importance of proper segregation, storage, transportation, treatment, and disposal.

Segregation at the point of generation is one of the most essential steps in medical waste management. According to the World Health Organization (2014), proper segregation significantly reduces the risk to healthcare workers and minimizes the quantity of waste requiring advanced treatment. When segregation is not practiced, general waste becomes contaminated, increasing treatment costs and risks.

Healthcare workers are particularly vulnerable to the risks associated with improper handling of sharp materials and infectious waste.The World Health Organization (2010) estimates that approximately sixteen billion injections are administered globally each year. When healthcare workers are not adequately informed about the dangers of unsafe disposal and needle-stick injuries, their risk of exposure to bloodborne diseases such as human immunodeficiency virus, hepatitis B, and hepatitis C increases sharply. In addition to health risks, improper disposal practices such as open dumping or uncontrolled burning release toxic substances like dioxins and furans into the environment.

Various technologies such as incineration, and chemical disinfection are used in treating medical waste. However, their effectiveness often depends on the awareness and safe handling practices of healthcare

The World Health Organization (2023) reported that the global prevalence of acute hepatitis B virus (HBV) infection among health workers is estimated at 5.3%. Additionally, needlestick injuries are a major cause, contributing to 37% of hepatitis B infections, 39% for hepatitis C, and 4.4% for HIV. This issue is more severe in developing countries, where as many as ninety percent of healthcare workers are at risk. The situation is further worsened by limited emphasis on training and education related to healthcare waste handling. Many staff members, especially those not directly involved in clinical care, may not receive adequate instruction on how to safely manage hazardous waste.

The consequences of poor medical waste management go beyond health related outcomes. Improper practices such as open dumping, unregulated burial, and uncontrolled burning contribute to serious environmental degradation. These methods release toxic chemicals into the air, soil, and water, with substances like dioxins and furans posing long-term threats to public health. In Nigeria, such disposal methods are still commonly used. Inadequate knowledge among healthcare workers often contributes to these environmentally harmful practices, especially when staff are unaware of safe disposal procedures.

Although national policies exist, such as the National Healthcare Waste Management Policy of 2006 and the establishment of the National Environmental Standards and Regulations Enforcement Agency in 2007, enforcement is inconsistently applied. Limited

awareness of these provisions among healthcare workers contributes to continued unsafe practices, highlighting the need for improved education and training.

There is a noticeable gap in literature assessing how much different categories of staff especially cleaners, waste handlers, and ward attendants understand the risks associated with medical waste. For instance, Musa et al (2023) found that while doctors, nurses, and laboratory scientists demonstrated good knowledge of medical waste handling (scoring approximately eighty-five percent), cleaners and ward attendants showed very low levels of awareness. This disparity highlights the need to study the knowledge of all healthcare workers, not just professionals, in order to design inclusive and effective interventions.

In urban locations such as Benin City in Edo State, medical waste management challenges are especially acute. The city hosts many health facilities that lack adequate waste segregation systems and trained personnel. As the population grows and healthcare demand rises, so does the volume of waste, increasing risks to public health and the environment particularly when healthcare workers lack the necessary knowledge. These realities underscore the need to assess the level of knowledge among healthcare workers regarding the dangers of improper medical waste handling in Primary Health Centres in Egor Local Government Area, Benin City. This will help identify training gaps and improve waste management.

Statement of the Problem

Medical waste management continues to pose a major public health and environmental challenge in Nigeria. Despite the introduction of national guidelines such as the National Healthcare Waste Management Policy (2006), unsafe practices such as poor segregation of waste, open dumping, and uncontrolled burning are still widely observed in many health facilities. These practices increase the risk of occupational exposure to blood-borne infections like hepatitis B, hepatitis C, and HIV among healthcare workers, while also releasing harmful pollutants that endanger the wider community and environment.

Previous studies in Nigeria (e.g., Okechukwu et al., 2017; Musa et al., 2023) have investigated healthcare workers' knowledge of medical waste management and reported varying levels of awareness across different staff categories. Some of these studies have also considered demographic factors such as job role, years of experience, and educational level when analyzing knowledge. However, these findings are often context-specific, focusing on particular hospitals or states, and may not reflect the realities of Primary Health Centres (PHCs) in Egor Local Government Area of Edo State.

In Egor Local Ggovernment Area, where Primary Health Centres generate considerable amounts of hazardous waste daily, little is known about the extent of healthcare workers' knowledge of the dangers associated with improper medical waste handling and disposal. This lack of context-specific evidence makes it difficult to understand knowledge gaps across all categories of Primary Health Centre workers in the area.

This study is therefore motivated by the need to provide empirical data on the knowledge of healthcare workers in Primary Health Centres across Egor Local Government Area, Benin City. By examining existing knowledge levels and how demographic factors influence knowledge, the study will provide evidence that can guide policymakers, health managers, and researchers in strengthening medical waste management through appropriate policies, training, and future research.

Research Questions

This study seeks to answer the following research questions:

1. What is the level of knowledge among healthcare workers regarding the dangers associated with medical waste management?

2. What is the level of knowledge among healthcare workers in relation to the safe handling and disposal of medical waste?

3. What is the level of knowledge of healthcare workers on waste management practices?

4. Is there a relationship between healthcare workers' knowledge on safe handling and disposal of medical waste and waste management practice?

5. To what extent will demographic variables influence the level of knowledge of healthcare workers regarding medical waste danger?

Hypotheses

Based on the research questions, the following hypotheses will be tested in this study:

H_{01} : There is no significant relationship between healthcare workers' knowledge on safe handling and disposal of medical waste, and their waste management practices in Egor Local Government Area.

H_{02} : Demographic variables will not significantly influence the level of knowledge of healthcare workers regarding medical waste dangers in Egor Local Government Area.

Purpose of the Study

The purpose of this study is to assess the knowledge of healthcare workers in Primary Health Centres in Egor Local Government Area, Benin City, regarding the dangers associated with medical waste management. Specifically, the study seeks to:

1. Determine the level of understanding among healthcare personnel about health and environmental hazards related to improper handling and disposal of medical waste.
2. Examine the level of knowledge of healthcare workers in relation to the safe handling and disposal of medical waste.
3. Assess the level of knowledge of healthcare workers on waste management practices.
4. Investigate the relationship between healthcare workers' knowledge and their waste management practices.
5. Determine the extent to which demographic variables (such as job role, years of experience, and educational level) influence the level of knowledge of healthcare workers regarding medical waste dangers.

Significance of the Study

This study is significant for several reasons: It provides essential information on the level of awareness among healthcare workers concerning the dangers of medical waste. By identifying existing knowledge gaps ,the study will help healthcare administrators and policymakers to design more effective training programs tailored to the needs of their staff.

The study emphasizes the importance of safe medical waste management in protecting not only healthcare workers but also patients and the broader community. Proper handling of waste reduces the risk of infection transmission, occupational injuries and environmental pollution.

The findings from this study will contribute to the growing body of academic research on medical waste management in Nigeria.It will provide empirical data that future researchers can build upon and may encourage more indepth investigations into related areas, such as compliance monitoring and environmental impact assessment.

Healthcare administrators and policymakers in Edo State will benefit from data-driven insights to inform training programs, enforcement policies, and waste management reforms.

Healthcare workers themselves may gain from better-targeted education, leading to improved safety, reduced occupational risks, and more sustainable environmental practices.

Ultimately, this study contributes to the broader goal of protecting public health and ensuring that healthcare delivery does not unintentionally harm healthcare workers or the environment.

Scope / Delimitation of the Study

This study is delimited to Primary Health Centres in Egor Local Government Area, Benin City, Edo State. It focuses on assessing the knowledge of healthcare workers regarding the dangers associated with medical waste management. The categories of healthcare workers considered in this study include both clinical staff (such as doctors, nurses, and laboratory scientists) and non-clinical staff (such as cleaners, ward attendants, and waste handlers) who are directly or indirectly involved in the generation and handling of medical waste.

The study examines healthcare workers' level of knowledge in three main areas: the dangers of medical waste, safe handling and disposal, and waste management practices. It also investigates whether there is a relationship between healthcare workers' knowledge and their waste management practices, and the extent to which demographic variables influence knowledge levels.

The study is confined to Primary Health Centres within Egor Local Government Area only, and its findings may not be generalized to all healthcare facilities in Edo State or Nigeria as a whole. Data will be collected using a structured questionnaire, and the study will not involve experimental testing of waste disposal methods, direct observation of waste handling, or laboratory analysis of environmental contamination.

Definition of Terms

- Healthcare Workers (HCWs): Individuals involved in delivering healthcare services or handling medical waste, including clinical and non-clinical staff.
- Medical Waste: Waste produced in the process of medical treatment or research, which may be infectious, toxic, or hazardous.
- Medical Waste Management:The systematic process of segregation, collection, storage, transport, treatment, and disposal of healthcare waste.
- Dangers of Medical Waste:The potential health risks (e.g., HIV, Hepatitis, chemical burns) and environmental threats (e.g., water pollution, toxic air) posed by unsafe waste practices.
- Knowledge: Awareness and understanding of facts, information and procedures related to medical waste dangers and safe handling practices.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviews literature on healthcare waste management with emphasis on healthcare workers' knowledge of the dangers involved. It shall be discussed under the following sub headings;

- Concept of Medical Waste
- Dangers Associated with Medical Waste
- Healthcare Workers' Knowledge of Medical Waste Dangers
- Healthcare Workers' Knowledge of Safe Handling of Medical Waste
- Healthcare Workers' Knowledge of Waste Management Practices
- Demographic Variables and Medical Waste Dangers
- Summary of the Literature Review

Concept of Medical Waste

Medical waste, also referred to as healthcare waste or biomedical waste, is a distinct category of waste generated as a by-product of healthcare delivery. The World Health Organization (2018) defines healthcare waste as "all the waste generated by healthcare establishments, research facilities, and laboratories, including the waste originating from minor or scattered sources such as that produced in home-based healthcare." This definition emphasizes that medical waste arises not only from large hospitals but also from smaller facilities such as primary health centres, diagnostic laboratories, pharmacies, veterinary clinics, and households where medical care is delivered. The Federal Ministry

of Health of Nigeria, in its National Healthcare Waste Management Policy (2013), adopts a similar approach and underscores that healthcare waste comprises both hazardous and non-hazardous components, each of which requires tailored management strategies.

Healthcare waste is not homogeneous. The World Health Organization (2018) estimates that approximately 75 to 90 percent of healthcare waste is comparable to ordinary domestic waste, whereas about 10 to 25 percent is hazardous and contains infectious agents, sharps, toxic chemicals, or pharmaceuticals. Although this hazardous fraction is smaller by weight, it accounts for the majority of occupational and environmental risks linked to healthcare delivery. The United Nations Environment Programme (2020) similarly notes that even small quantities of hazardous healthcare waste can produce severe health and environmental outcomes when managed unsafely.

Sources of medical waste reflect the continuum of healthcare delivery. Tertiary hospitals generate diverse and voluminous streams, but primary health centres also produce potentially hazardous wastes from immunization services, wound dressing, childbirth, antenatal care, and minor surgical procedures. The World Health Organization (2018) lists common sources as inpatient wards, outpatient clinics, operating theatres emergency units, diagnostic laboratories, pharmacies, blood banks, and mortuaries. Home-based care for chronic conditions and community outreach programmes, such as vaccination campaigns, are increasingly recognized contributors to healthcare waste. With the expansion of healthcare delivery services, population growth, and advances in medical technology, the volume and complexity of medical waste have increased substantially

across the globe, particularly in developing countries where management practices are often inadequate (Chartier et al., 2014).

Categories of healthcare waste are generally divided into hazardous and non-hazardous groups. Hazardous medical waste includes the following types:

- Infectious waste (e.g., blood-soaked dressings, culture media, swabs) arises from laboratory diagnostics, patient isolation wards, and outpatient procedures, and must be managed to prevent pathogen transmission (UNEP, 2020).
- Sharps (e.g., needles, scalpel blades, broken glass, syringes) are generated mainly in surgical theatres, emergency units, and vaccination centres. They pose a high risk of needle-stick injuries, requiring puncture-proof containers for safe disposal (WHO, 2018).
- Pathological and anatomical waste: They include everything from lab cultures and stocks to donated blood and tissue collected for testing or removed during surgery. Anatomical waste is a subtype of pathological waste, being recognizably human materials, such as an amputated limb.
- Radioactive waste:Not all facilities produce radioactive waste, but it can result from treatment (for example, radioactive tracers) or be present in diagnostic and analytical equipment.
- Chemical waste (e.g., solvents, reagents, disinfectants) originates chiefly from laboratories, sterilization departments, and pharmacy stock management.

These chemicals can be toxic or corrosive, necessitating specialized disposal routes.

- Pharmaceutical and cytotoxic waste (expired drugs, chemotherapy residues) comes from pharmacy stores, oncology wards, and research labs. Improper disposal of cytotoxic substances and expired pharmaceuticals has been shown to contaminate surrounding soils and water bodies (Awodele, Adewoye, & Oparah, 2016).

In Nigeria, the National Environmental Standards and Regulations Enforcement Agency (NESREA, 2009; 2022) provides legal instruments for classifying and managing healthcare waste and recommends segregation using color-coded containers appropriate to waste type. Despite this regulatory framework, field studies show that compliance at facility level remains weak, particularly in lower-tier facilities that lack infrastructure and routine training (Awodele, Adewoye, & Oparah, 2016; Oyekale, 2017).

Overall, the concept of medical waste is multidimensional and spans a wide range of sources and materials. While most healthcare waste resembles domestic refuse, the smaller hazardous fraction poses significant occupational, community, and environmental threats. This conceptual clarity is necessary for designing survey instruments and operational definitions used in this study, which aim to measure healthcare workers' knowledge about different waste types and their associated risks.

Dangers Associated with Medical Waste

The hazards associated with medical waste are well established and affect healthcare workers, patients, communities, and the broader environment. These dangers arise primarily from hazardous waste fractions, infectious materials, sharps, pharmaceuticals, chemicals, and radioactive substances that, when incorrectly handled or disposed of, create pathways for injury, infection, and contamination. The World Health Organization (2022) emphasizes that poor management of healthcare waste contributes to occupational injuries, the transmission of infectious diseases, and environmental degradation

Improper handling and disposal of medical waste present significant dangers to healthcare workers, patients, communities, and the environment. These dangers manifest in several interconnected dimensions

1. Health Hazards to Healthcare Workers and Waste Handlers

Healthcare workers face some of the most direct risks from medical waste. The World Health Organization (WHO, 2022) estimates that over 3 million healthcare workers experience sharps injuries annually, exposing them to infectious diseases such as HIV, hepatitis B (HBV), and hepatitis C (HCV). More recent WHO analyses show that unsafe sharps injuries account for 37% of HBV, 39% of HCV, and 4.4% of HIV infections in healthcare workers. Waste handlers, porters, and cleaners often excluded from formal training and lacking personal protective equipment are disproportionately affected. These exposures result in acute and chronic infections, long-term disability, and in some cases, death.

A study conducted by Oyekale (2017) revealed that 41% of healthcare workers had experienced accidental exposure to infectious medical waste in the prior year. Similar findings were reported in Northern Nigeria, where Audu and Lawan (2019) observed that healthcare workers in tertiary hospitals faced frequent needle-stick injuries due to poor sharps disposal. Such exposures can lead to acute or chronic infections, and long-term illness. Furthermore, cleaners and ward attendants, who often handle waste without adequate knowledge or protection, face higher risks than doctors or nurses (Yakubu, Bello, & Tsiga-Ahmed, 2023).

2. Environmental Hazards

Inadequate treatment and disposal of healthcare waste cause severe environmental contamination. Open burning or low-temperature incineration releases dioxins, furans, mercury, and particulate matter, all of which are linked to cancers, developmental disorders, and respiratory diseases (UNEP, 2022). Unregulated dumping and shallow burial lead to leachates contaminating groundwater and soils, threatening food security and drinking water safety. Pharmaceutical and cytotoxic wastes have also been detected in rivers and soils near poorly managed facilities, creating long-term ecological risks.

3. Community and Public Health Risks

Medical waste that is not properly contained creates risks beyond the hospital environment. Anatomical and pathological wastes attract rodents, flies, and stray animals, serving as vectors for disease outbreaks. In some communities, the reuse of discarded syringes and sharps has been documented, leading to localized outbreaks of bloodborne

infections. Furthermore, improper disposal of expired drugs and chemicals can result in toxic exposure in surrounding populations, undermining public health.

4. Pandemic and Emergency Waste Burdens

Public health emergencies such as Ebola and COVID-19 have amplified the dangers associated with medical waste. During the COVID-19 pandemic, WHO (2021) recommended that all COVID-related waste including PPE, swabs, and test kits be treated as infectious and disposed of within 48 hours. However, in many low-resource settings, healthcare facilities lacked functional incinerators or autoclaves, leading to reliance on unsafe practices such as open burning and shallow burial. This not only increased the risk of occupational exposure but also heightened community transmission risks during already fragile health crises.

5. Psychosocial and Economic Consequences

Beyond direct health and environmental risks, poor medical waste management has wider societal impacts. Workers regularly exposed to hazardous waste without proper protection experience heightened stress, fear of infection, and reduced job satisfaction. At the societal level, visible mismanagement of waste such as syringes scattered in open dumps erodes public trust in healthcare facilities. Economically, the costs of treating occupational infections, environmental clean-up, and litigation significantly burden already strained healthcare systems.

In summary, the dangers of medical waste extend well beyond hospital boundaries, encompassing occupational health risks, environmental degradation, community

exposure, and broader psychosocial and economic consequences. Addressing these dangers requires robust enforcement of waste segregation, provision of functional treatment technologies, investment in protective infrastructure, and continuous capacity building for all categories of healthcare workers.

Medical Waste Management

Medical waste management is a critical dimension of healthcare delivery and public health protection. It refers to the totality of measures taken to ensure that waste generated in healthcare facilities is safely handled, transported, treated, and disposed of in ways that minimise risks to health workers, patients, communities, and the environment. The World Health Organization (2014) describes it as an integrated system that requires proper planning, financial investment, human resource training, behavioural change, and continuous supervision. The United Nations Environment Programme (2020) adds that effective medical waste management is an essential component of environmental sustainability because healthcare waste, if mishandled, can compromise air quality, contaminate water sources, degrade soil, and endanger biodiversity.

Global Perspective

Globally, developed countries have well-established medical waste management systems supported by strict regulations, adequate infrastructure, and consistent monitoring. For instance, in the United States and many European countries, segregation at source is mandatory, and advanced treatment technologies such as autoclaving, microwaving, and high-temperature incineration are widely applied. Waste is tracked through “cradle-to-

grave" systems that ensure accountability from generation to final disposal. In contrast, in many developing countries, including Nigeria, medical waste management systems are characterised by weak enforcement of policies, insufficient infrastructure, and poor knowledge among staff (UNEP, 2020). These disparities highlight the global inequities in healthcare waste management and show why local research is essential for developing context-appropriate interventions.

Segregation

Segregation is the foundation of medical waste management. It involves separating hazardous from non-hazardous waste at the point of generation, usually through a colour-coded system. The World Health Organization (2018) recommends that black bags be used for general waste, yellow for infectious waste, red for sharps, and brown for chemical and pharmaceutical waste. The Federal Ministry of Health (2013) adopted these guidelines in Nigeria's National Healthcare Waste Management Policy. Despite the existence of this framework, empirical studies demonstrate poor compliance. Awodele, Adewoye, and Oparah (2016) observed that less than half of hospitals in Lagos State consistently segregated waste. Instead, sharps and infectious waste were often found mixed with domestic waste, exposing handlers and cleaners to serious risks. Similar findings were reported in Ethiopia and Ghana, where staff awareness of colour coding was high, but actual practice was limited by insufficient supply of bags and containers (Debere et al., 2013; Asante et al., 2016). These studies suggest that knowledge alone is insufficient without adequate resources and supervision.

Collection and Internal Transportation

After segregation, waste must be collected and transported safely within healthcare facilities. International standards recommend the use of leak-proof, puncture-resistant containers, clearly labelled with biohazard symbols. Collection should follow designated routes that avoid patient care areas and food preparation spaces. The World Health Organization (2014) stresses that failure to observe these precautions can spread contamination within hospitals, leading to secondary infections. In Nigeria, however, internal transportation remains a weak link. Oyekale (2017) found that in several facilities, cleaners transported uncovered sharps containers by hand without gloves, while Yakubu et al.(2023) reported similar unsafe practices in Kano. These lapses reflect both inadequate training and lack of protective infrastructure.

Storage

Temporary storage of medical waste should be secure, well-ventilated, and inaccessible to unauthorised persons or scavengers. Infectious waste should not remain in storage for more than 48 hours in warm climates, as microbial growth increases with time. The United Nations Environment Programme (2020) identifies unsafe storage as one of the most common breaches in developing countries. In Lagos, Awodele et al. (2016) observed that waste was often stored for up to a week due to irregular collection, leading to odour, vermin infestation, and community complaints. In India and Bangladesh, similar problems have been reported, with temporary storage areas located close to patient wards or kitchens, increasing the risk of contamination (Patwary et al., 2011).

These findings underscore the need for consistent collection schedules, dedicated storage areas, and staff awareness of safe storage timelines.

Treatment and Disposal

Treatment is the stage at which hazardous waste is rendered safe before final disposal. Common methods include autoclaving, chemical disinfection, incineration, and, increasingly, microwave treatment. Autoclaving is effective for infectious waste but not suitable for chemical or pharmaceutical waste. Chemical disinfection, usually with chlorine-based solutions, can treat liquid waste but poses environmental risks if not properly managed. Incineration is widely used but, when poorly operated, releases toxic pollutants such as dioxins and furans. The World Health Organization (2018) warns that open burning, which remains common in low-resource settings, is both ineffective and environmentally damaging.

In Nigeria, treatment and disposal are among the weakest components of medical waste management. Oyekale (2017) documented that in many rural facilities, open burning and burial were the predominant disposal methods. Even in urban centres, incinerators are often poorly maintained, lack emission controls, or are located near residential areas. A study by Adegboye et al. (2018) reported that some Nigerian hospitals discharged untreated liquid waste directly into municipal drains, creating further environmental hazards. These findings demonstrate the gap between policy and practice, as Nigeria's National Healthcare Waste Management Policy (2013) explicitly prohibits open burning and unsafe disposal.

Policy and Regulatory Frameworks

An effective medical waste system depends first and foremost on the presence of clear, implementable policies and enforceable regulations. At the global level, the World Health Organization's Safe Management of Wastes from Health-care Activities (second edition) sets out a comprehensive framework that defines key concepts, prescribes a "generation-to-final-disposal" approach, and describes preferred technical options (segregation, non-burn technologies for infectious waste where possible, high-standard incineration only where necessary) along with managerial measures such as training, record-keeping and monitoring (World Health Organization, 2014). The World Health Organization also issues topical guidance and fact sheets that summarise risk proportions (for example, the estimate that roughly 10–25 percent of healthcare waste is hazardous) and emphasise segregation at source as the single most important control. These global instruments provide authoritative technical norms that countries are expected to adapt to their contexts.

The United Nations Environment Programme complements the World Health Organization by elaborating technology compendia and environmental safeguards for waste-treatment options, particularly on avoiding toxic emissions from open burning and low-temperature incineration (United Nations Environment Programme, 2012; United Nations Environment Programme, 2020). Its technical guidance is widely used to inform national choices about treatment technology mixes and emissions controls.

At the national level, Nigeria has established formal policy instruments intended to translate these global norms into law and practice. The Federal Ministry of Health published the National Healthcare Waste Management Policy in 2013, which articulates responsibilities for waste segregation, safe storage, transport, treatment and disposal, and calls for training, monitoring and interagency coordination (Federal Ministry of Health, 2013). The National Environmental Standards and Regulations Enforcement Agency issues sectoral regulations, published in the Federal Republic of Nigeria Official Gazette, that provide statutory backing for enforcement, set technical standards and require environmental permits where applicable (National Environmental Standards and Regulations Enforcement Agency, 2009; National Environmental Standards and Regulations Enforcement Agency, 2022). These documents together form the formal regulatory architecture that should govern practice in Nigerian facilities.

Despite the existence of these instruments, international and national guidance share common features that matter for implementation: clear assignment of responsibilities (health facilities, waste transporters, environmental regulators), mandatory segregation and labelling, requirements for safe transport and licensed final disposal, mandatory training and record-keeping, and monitoring and sanctions for non-compliance. The literature suggests that when these elements are present and enforced, facility-level outcomes improve; conversely, gaps in any pillar undermine the whole system (World Health Organization, 2014; United Nations Environment Programme, 2020).

Barriers to Effective Policy Implementation and Regulatory Enforcement

Although policy frameworks exist, a substantial implementation gap persists in Nigeria and many comparable settings. The barriers are multiple and interlocking; below I expand the principal categories with evidence:

1. Structural and technical barriers

Structural and technical barriers are among the most critical challenges to effective medical waste management. These barriers arise from weaknesses in the infrastructure, equipment, and technologies that are necessary for the safe handling, treatment, and disposal of healthcare waste. In many Nigerian healthcare facilities, particularly at the primary care level, these structural systems are either absent or inadequate, which undermines compliance with recommended waste management practices (Coker et al., 2009; Oyekale & Oyekale, 2017).

A major structural barrier is the lack of reliable segregation systems. Many facilities do not have adequate colour-coded bins or dedicated storage areas for different categories of waste. This often results in the mixing of infectious waste with non-infectious waste, making safe treatment and disposal more difficult. In situations where bins are provided, they may be insufficient in number or not emptied regularly, leading to overfilled containers that pose risks of needle-stick injuries and exposure to infectious materials (Awodele, Adewoye, & Oparah, 2016).

Another technical challenge relates to the absence of appropriate treatment technologies. In most parts of Nigeria, crude disposal methods such as open burning and the use of

low-capacity incinerators are still common. These practices are ineffective and often generate hazardous emissions, including dioxins and furans, which threaten both public health and the environment (Oyekale & Oyekale, 2017). In some cases, untreated waste is dumped in open pits or municipal landfills, further spreading risks to waste handlers and surrounding communities.

Transportation also reflects structural and technical shortcomings. In many areas, the same vehicles used for domestic waste collection are also used for medical waste, usually without specialised containers or adequate disinfection. This practice increases the risk of contamination during waste movement and undermines infection control measures (World Health Organization, 2018).

Overall, structural and technical barriers demonstrate that even when healthcare workers have the necessary knowledge, their ability to comply with safe practices is limited by the absence of enabling infrastructure. Sustainable improvements in medical waste management therefore require investment in proper segregation systems, safe treatment technologies, and dedicated transportation structures to complement training and policy enforcement.

2. Financial constraints

Sustainable medical waste management requires recurring budgets for consumables, maintenance of treatment equipment, fuel or energy for autoclaves, and contracts for licensed transport and disposal. Local health budgets and facility operating budgets often do not include dedicated line items for waste management; where funding is inadequate,

procurement of essential supplies is irregular and preventive maintenance of equipment is neglected.

3. Governance and enforcement weaknesses

Even where technical standards exist, enforcement is often weak because environmental and health regulatory agencies are under-resourced and interagency coordination is limited. Routine inspections, permit systems, emissions monitoring and sanctions are irregular or absent. Oyekale's national assessment documented inconsistent application of regulations and low inspection intensity, which reduces the deterrent effect of the law and allows unsafe practices to persist (Oyekale & Oyekale, 2017).

4. Human resource and training barriers

Training is an essential policy requirement, but it is unevenly delivered. Non-clinical cadres-cleaners, porters and waste handlers, are frequently excluded from formal training even though they handle waste most often. Facility-level studies in Nigeria repeatedly report higher knowledge and compliance among doctors and pharmacists and lower levels among non-clinical staff, reflecting unequal inclusion in capacity-building (Awodele et al. (2016); Yakubu et al.2023). Gaps in supervision and refresher training further erode skills over time.

5. Logistical barriers (transport and centralized treatment)

Regional or centralized treatment facilities can deliver economies of scale, but they require reliable, tracked transport. In many jurisdictions, waste transport contracts are informal, vehicles are unlabelled or leak-prone, and documentation of handover is

missing, raising safety and legal risks. Where centralized options are not available, small facilities resort to open burning or shallow burial. Coker et al. (2009) documented these challenges in Nigerian hospitals, where primary care facilities often lacked access to reliable waste transport and disposal options, forcing staff to rely on crude methods such as open burning and shallow burial.

6. Cultural and managerial attitudes

Perceptions that waste handling is "low-status" work, coupled with management attitudes that deprioritize waste management in favor of clinical services, reduce institutional ownership. Staff may view compliance as optional and consider investments in waste systems as less urgent than clinical supplies. This cultural de-prioritization translates into poor supervision and weak enforcement at facility level (Awodele et al., 2016).

7. Emergency surge and contingency gaps

Pandemics and mass campaigns strain systems. The coronavirus disease 2019 pandemic revealed that many facilities had no contingency protocols or excess capacity for surge volumes of infectious waste, and temporary measures sometimes violated environmental or occupational safety norms (World Health Organization, 2021; United Nations Environment Programme, 2022). Policies often lack practical, budgeted contingency clauses that are readily executable at facility level.

Implications

The persistent implementation gaps in medical waste management policies and practices have significant implications for occupational safety, environmental health, and the overall performance of healthcare systems.

One major implication is the heightened risk to occupational health and safety. Where segregation is not enforced, protective equipment is lacking, and unsafe treatment methods such as open burning are used, healthcare workers are directly exposed to infectious agents, toxic chemicals, and accidental injuries. Studies in Nigeria demonstrate that poor adherence to policy guidelines correlates with frequent sharps injuries and accidental exposures among staff (Awodele et al.2016; Oyekale & Oyekale, 2017). Such exposures undermine workforce well-being and contribute to absenteeism and long-term health burdens.

Another implication is the risk of environmental contamination. Unsafe disposal practices such as uncontrolled burning, shallow burial, or the discharge of untreated liquid waste introduce hazardous pollutants into the soil, water, and air. The United Nations Environment Programme (2020) has documented that low-resource countries bear a disproportionate burden of environmental degradation linked to poorly controlled healthcare waste treatment. This contamination has ripple effects, threatening not only local ecosystems but also community health through polluted water sources and contaminated agricultural land.

The gaps in enforcement and compliance also have systemic implications for health service delivery. Poorly managed medical waste reduces public trust in healthcare institutions when communities perceive that facilities expose them to danger rather than protection. At the same time, inequities are reinforced, as smaller and rural facilities, where resources and oversight are weakest -experience greater difficulties in safe waste management. Non-clinical staff, who often bear the greatest exposure, are disproportionately affected when training and protective measures are insufficient. This uneven distribution of risks highlights broader issues of fairness and sustainability within the healthcare system (Yakubu et al.2023).

Finally, the literature shows that weak medical waste management systems limit preparedness for health emergencies. During the coronavirus disease 2019 pandemic, healthcare facilities in Nigeria and other low- and middle-income countries struggled to cope with the surge of infectious and sharps waste. The World Health Organization (2021) reported that inadequate contingency planning and insufficient infrastructure led to unsafe handling and disposal practices, creating secondary risks at a time when health systems were already strained. This underscores how lapses in routine waste management have direct implications for resilience during crises.

In summary, the literature demonstrates that weak implementation of medical waste management policies has wide-ranging consequences: it undermines occupational safety, contaminates the environment, erodes public trust in healthcare systems, and reduces resilience in the face of public health emergencies. These implications provide a strong

justification for studies that examine healthcare workers' knowledge and practices, since such knowledge is central to translating policy into safe and effective action.

Healthcare Workers' Knowledge on Safe Handling of Medical Waste

Safe handling of medical waste refers to the set of precautionary measures that healthcare workers are expected to apply when coming into contact with hazardous and non-hazardous waste during collection, movement, temporary storage, and preliminary treatment. Unlike general waste management practices, which describe a broad process from generation to final disposal, safe handling emphasises the personal behaviours and protective actions that reduce direct exposure. Knowledge of safe handling therefore acts as the bridge between abstract awareness of dangers and the practical steps required to avoid injury, infection, and environmental contamination. The World Health Organization (2014) explains that safe handling requires workers to understand three key dimensions: the nature of hazards, the pathways of exposure, and the protective behaviours and equipment required to interrupt those pathways.

Knowledge of safe handling begins with an understanding of the need for personal protective measures. Healthcare workers must know that handling waste with bare hands or without appropriate clothing exposes them to infectious agents, toxic chemicals, and accidental injuries.Personal protective equipment such as gloves, aprons, boots, face masks, and goggles serves as the first line of defence. However, research indicates that knowledge of appropriate protective equipment is uneven. In Uganda, for example, a study by Ndejjo et al. (2015) found that although healthcare workers were aware of

personal protactive equipment, compliance with consistent use was poor, especially among non-clinical staff. Similar trends have been observed in other African countries, where workers often relied only on gloves while neglecting more comprehensive protection such as masks or goggles. For example, many workers believed that gloves alone were sufficient when handling chemical waste, neglecting the need for eye and respiratory protection. This knowledge gap contributes to unsafe handling behaviours and increased occupational vulnerability.

Safe handling also requires knowledge of proper lifting, carrying, and transporting techniques. Healthcare workers should know that bags of infectious waste must be securely tied, not overfilled, and carried in leak-proof containers to avoid spills. They should also be aware that waste must never be compressed manually and should not be transported through areas where patients or food are present. The World Health Organization (2018) emphasises that failure to follow these procedures can spread contamination within facilities and expose both staff and patients to infection. Yet empirical studies reveal that many Nigerian healthcare workers are unaware of these handling precautions. Oyekale (2017) reported that more than 30 percent of staff surveyed did not know that waste bags should be sealed before transport, and nearly half admitted that they often carried waste through crowded corridors because they were unaware of alternative routes. These findings demonstrate a direct link between poor knowledge of handling precautions and unsafe behaviours within facilities.

Another critical dimension of safe handling knowledge relates to sharps. Healthcare workers should understand that needles and blades require special handling because even a minor puncture can transmit life-threatening infections. Knowledge must extend beyond disposal into sharps containers; it must include safe handling during procedures, immediate placement of used sharps without passing them hand-to-hand, and an absolute prohibition on manual recapping. Yakubu et al. (2023) observed that although most doctors and nurses at Murtala Muhammad Specialist Hospital in Kano were knowledgeable about sharps handling, many cleaners and auxiliary staff did not fully understand these precautions. Several believed that recapping was necessary to prevent injuries, reflecting a knowledge gap that increases risk instead of reducing it.

Safe handling knowledge is also important during emergency situations and mass immunisation campaigns, when the volume of infectious and sharps waste rises sharply. Workers must know that handling capacity during such surges requires additional protective equipment, more frequent waste collection, and stricter adherence to segregation and transport procedures. The World Health Organization (2021) noted that during the coronavirus disease 2019 pandemic, facilities that failed to train staff on safe handling of pandemic-related waste experienced increased contamination and occupational exposure. In Nigeria, many primary health centres lacked specific training, leading to unsafe disposal of personal protective equipment alongside domestic refuse. These experiences highlight the importance of equipping healthcare workers with

knowledge of safe handling not only in routine practice but also during public health emergencies.

Beyond personal protective measures, healthcare workers require knowledge of safe handling at the point of temporary storage. Infectious waste awaiting treatment should be placed in secure, covered containers in designated storage areas that are well ventilated and inaccessible to the public. Workers must know that improper handling during storage, such as leaving bags open or stacking containers haphazardly, increases the risk of spills, vermin infestation, and environmental contamination. The United Nations Environment Programme (2020) stresses that unsafe storage is one of the most common breaches of safe handling in low and middle income countries. In Nigerian facilities, studies have documented unsafe practices that can be traced back to knowledge gaps. Awodele, Adewoye, and Oparah (2016) reported that many healthcare workers did not know that infectious waste should not remain in storage beyond 48 hours in warm climates, and as a result, waste was often stored for prolonged periods in unsafe conditions.

Safe handling knowledge also includes awareness of incident reporting procedures. Workers must know what steps to take if they are exposed to waste through a spill, splash, or injury. This includes immediate first aid, prompt reporting to supervisors, and seeking medical evaluation for possible post-exposure prophylaxis. Where knowledge of reporting protocols is weak, incidents often go unreported, leading to missed opportunities for treatment, surveillance, and institutional learning. Oyekale (2017) found that fewer than half of surveyed healthcare workers in Nigeria knew the correct reporting

procedures for exposure incidents, while Yakubu et al. (2023) noted that cleaners in Kano often treated minor needle-stick injuries themselves without reporting them, exposing themselves to long-term health risks.

The reviewed evidence makes clear that knowledge of safe handling varies by cadre, education, and access to training. Professional staff such as doctors and pharmacists tend to have greater theoretical understanding, while nurses acquire knowledge through repeated practice. Non-clinical staff, who handle waste most directly, often have the least knowledge because they are excluded from formal training. This contradiction where those at greatest risk have the least knowledge, underscores the urgency of making safe handling knowledge universal across all cadres. Continuous training and the integration of safe handling modules into staff orientation can help bridge this gap. The Federal Ministry of Health (2013) and the National Environmental Standards and Regulations Enforcement Agency (2022) both emphasise training as a critical component of healthcare waste management, but empirical studies suggest that implementation remains inconsistent.

In conclusion, safe handling knowledge is central to protecting healthcare workers and communities from the hazards of medical waste. It requires awareness of personal protective measures, safe lifting and transport, proper sharps handling, secure storage, and incident reporting procedures. The evidence from Nigeria and other low-resource settings shows that while some healthcare workers have adequate knowledge, significant gaps persist, particularly among non-clinical staff and during public health emergencies.

Without targeted training and reinforcement, these gaps perpetuate unsafe practices and undermine broader waste management systems. For the present study, assessing healthcare workers' knowledge of safe handling is essential, since it provides insight into both the individual behaviours and the systemic weaknesses that shape the safety of healthcare waste management in Egor Local Government Area.

Healthcare Workers' Knowledge of Medical Waste Dangers

Healthcare workers represent the frontline of defence against the hazards of medical waste because they are the first and most frequent handlers of infectious, chemical, pharmaceutical, and sharps waste generated in clinical settings. Their knowledge of the dangers associated with medical waste is therefore critical for preventing occupational injuries, protecting patients and communities, and ensuring compliance with environmental safety standards. The World Health Organization (2018) has emphasised that awareness of dangers is as important as technical capacity for waste management, since behaviour is shaped not only by rules and infrastructure but also by workers' perceptions of risk. Inadequate knowledge leaves healthcare workers vulnerable to exposure and may also place patients and surrounding communities at risk of infection and environmental contamination.

Awareness of occupational risks is the most immediate dimension of knowledge required by healthcare workers. Globally, evidence suggests that while many workers recognise that medical waste is hazardous, their understanding of the specific risks and pathways of harm is often incomplete. For example, the World Health Organization (2022) estimates

that more than three million healthcare workers suffer sharps-related injuries every year, a burden that results in substantial proportions of hepatitis B, hepatitis C, and human immunodeficiency virus infections among health professionals. These figures reveal a disconnect between general awareness and detailed knowledge of dangers. In the Nigerian context, Awodele, Adewoye, and Oparah (2016) reported that although a majority of workers in Lagos hospitals described healthcare waste as dangerous, fewer than half could correctly identify all categories of hazardous waste or explain the mechanisms by which infection could spread. Similarly, Oyekale (2017) observed that more than 40 percent of healthcare workers reported accidental exposure to hazardous waste within a single year, suggesting that knowledge gaps directly translate into risky behaviours and preventable exposures.

Knowledge of the dangers associated with sharps is a particularly critical area. Sharps such as needles and blades are widely recognised as a source of occupational injury, yet detailed understanding of their risks is uneven across cadres of workers. The World Health Organization (2022) has shown that unsafe sharps handling accounts for nearly 40 percent of hepatitis C infections and over 35 percent of hepatitis B infections among healthcare workers globally. However, studies indicate that in many facilities, non-clinical staff underestimate these risks. Yakubu, Bello, and Tsiga-Ahmed (2023), in a study conducted at Murtala Muhammad Specialist Hospital in Kano, found that while three-quarters of doctors and nurses were aware of the potential for hepatitis transmission from sharps injuries, fewer than half of cleaners and ward attendants demonstrated

similar knowledge. This discrepancy reveals that training and knowledge dissemination are disproportionately concentrated among professional cadres, leaving support staff highly vulnerable to infection.

Beyond sharps and infectious materials, healthcare workers also require knowledge of the dangers posed by chemical and pharmaceutical waste. Cytotoxic drugs, solvents, disinfectants, and mercury-containing equipment can cause genetic damage, reproductive toxicity, neurological problems, and chemical burns if improperly handled. The United Nations Environment Programme (2020) warns that unsafe handling and disposal of pharmaceutical waste not only endangers workers but also contributes to environmental contamination of water sources and agricultural land. In Nigeria, Awodele, Adewoye and Oparah (2016) reported that pharmacists in Lagos showed greater awareness of waste disposal regulations compared to nurses and non-clinical staff.This disparity illustrates the unequal distribution of knowledge across cadres, where those with specialist training are more informed, while the majority of healthcare workers remain at risk of mishandling pharmaceuticals and chemical residues.

Another important but often neglected aspect of knowledge concerns the psychosocial and environmental dangers of healthcare waste. Workers who lack confidence in their facility's waste management systems may experience stress, anxiety, and reduced morale, fearing exposure to life-threatening infections. At the community level, unsafe disposal practices such as open dumping or burning of contaminated materials can lead to the spread of pathogens, pollution of air and water, and the undermining of public trust in

healthcare services. In Lagos, Awodele et al. (2016) documented cases where poorly managed waste attracted vermin and scavengers, creating visible public health concerns. This limited scope of knowledge means that healthcare workers may not fully appreciate the wide-ranging dangers of poor waste management.

The coronavirus disease 2019 pandemic offers a stark example of how insufficient knowledge of medical waste dangers can escalate risks during public health emergencies. The pandemic generated unprecedented volumes of disposable protective equipment and diagnostic consumables. The World Health Organization (2021) warned that without adequate knowledge of how to handle such surges, facilities risked exposing staff and communities to secondary infections and environmental harm. In Nigeria, many facilities lacked contingency training, and healthcare workers often disposed of coronavirus-related waste alongside general refuse, reflecting a lack of preparedness and awareness of specific dangers during health crises. This experience highlights the importance of equipping healthcare workers not only with routine knowledge but also with an understanding of the dangers that emerge in emergency contexts.

Empirical studies further reveal that demographic variables shape healthcare workers' knowledge of medical waste dangers. Age, gender, years of experience, level of education, and cadre all influence awareness. Younger workers may be more familiar with recent training content, while older workers rely on experience. Doctors and pharmacists often display higher knowledge than nurses, who in turn tend to be more knowledgeable than auxiliary staff such as cleaners and porters. Where structured

training is absent, knowledge gaps are most pronounced among non-clinical staff. Oyekale (2017) found that healthcare workers who had attended waste management workshops in the preceding two years demonstrated significantly greater knowledge of infection risks compared to those without training. Yakubu et al. (2023) reinforced this finding by showing that non-clinical staff who participated in training scored higher on knowledge assessments than peers who had never been included. Training therefore acts as a key equaliser, bridging gaps across demographic and professional categories.

Taken together, the literature demonstrates that healthcare workers are generally aware that medical waste is hazardous, but their knowledge of specific dangers remains incomplete. Awareness is strongest for sharps and infectious materials but weaker for chemical, pharmaceutical, psychosocial, and environmental hazards. Knowledge is unevenly distributed across cadres, with doctors and pharmacists typically scoring highest and non-clinical staff lowest. Moreover, the absence of continuous training limits the retention and updating of knowledge. These gaps matter because they not only increase the risk of occupational exposure but also undermine the broader goals of safe healthcare waste management.

For the present study, these findings underscore the importance of focusing specifically on healthcare workers' knowledge of dangers associated with medical waste. By systematically assessing the extent of their knowledge, identifying variations across cadres and demographic groups, and exploring the relationship between knowledge and reported exposures, the study seeks to provide evidence for targeted training programmes

and policy interventions. Improved knowledge of dangers is the foundation upon which safe practices, compliance with regulations, and effective waste management systems must be built.

Knowledge of Healthcare Workers on Waste Management Practices

The knowledge that healthcare workers possess concerning healthcare waste management practices is a decisive factor in ensuring the safety of patients, staff, and communities. While awareness of dangers is necessary, knowledge of actual practices determines whether day-to-day waste handling will reduce or amplify risks. This knowledge is not abstract but highly practical. It encompasses the ability to segregate hazardous and non-hazardous waste correctly, to use and dispose of sharps containers appropriately, to select and wear the right protective equipment, to store and transport waste safely within the facility, and to understand treatment and final disposal methods. The World Health Organization (2014) stresses that safe management of healthcare waste cannot be achieved by infrastructure alone; it depends primarily on the actions and competencies of healthcare workers.

A fundamental area of knowledge is waste segregation at the point of generation. International guidance emphasises that segregation is the cornerstone of safe healthcare waste management because it limits the volume of hazardous waste requiring costly treatment and reduces occupational exposure. Healthcare workers must know not only that segregation is required, but also how to apply it correctly in busy clinical contexts. They need to identify which wastes are infectious, chemical, pharmaceutical, or sharps,

and they must know the correct containers to use. The Federal Ministry of Health (2013) introduced a color-coded segregation system for Nigerian facilities, while the National Environmental Standards and Regulations Enforcement Agency (2009; 2022) reinforced these guidelines through regulations. Despite this, research demonstrates significant knowledge gaps. In Lagos hospitals, Awodele, Adewoye, and Oparah (2016) found that although most workers understood the need for segregation, fewer than half could consistently apply the correct color coding. Oyekale (2017) also reported that many healthcare workers lacked knowledge of maximum storage times and often mixed hazardous waste with general refuse, undermining the benefits of segregation. These findings suggest that knowledge of segregation is frequently incomplete or theoretical, and that translating this knowledge into daily practice requires reinforcement through training and adequate provision of containers.

Closely related to segregation is knowledge of sharps management, which is among the most critical areas because of the high risk of bloodborne infections. Healthcare workers are expected to place used needles and blades immediately into puncture-proof containers, never to recap needles, and to close and replace containers when three-quarters full. They must also know the correct response in case of exposure, including first aid, immediate reporting, and access to post-exposure prophylaxis. Despite the importance of this knowledge, evidence from Nigeria shows that not all healthcare workers, especially non-clinical staff such as cleaners and waste handlers, are adequately informed. In Kano, Yakubu et al.(2023) demonstrated that while doctors and nurses had relatively good

knowledge of sharps disposal, many cleaners and ward attendants believed sharps containers could be reused, a misconception that heightens the risk of injuries and infections. This uneven distribution of knowledge suggests that training is often directed at clinical staff while non-clinical workers, who handle waste daily, are overlooked.

Another essential domain is the use of personal protective equipment during waste handling. Gloves, aprons, masks, goggles, and protective footwear are indispensable barriers against infection and chemical exposure. Healthcare workers must know which items are required for different waste streams and situations. Awareness, however, does not always translate into correct use. Udofia, Fobil, and Gulis (2017) similarly found that while healthcare workers in Southern Africa recognised the need for protective gear, fewer than half could correctly identify the specific personal protective equipment required for different categories of waste. This highlights that awareness is often theoretical and does not always translate into correct, consistent practice. Moreover, knowledge was uneven across cadres; doctors and nurses generally reported higher awareness than auxiliary staff. This suggests that gaps in knowledge about personal protective equipment contribute to inconsistent use and prevent healthcare workers from fully protecting themselves against hazards.

Knowledge of storage, transport, and treatment procedures is another critical area. The World Health Organization (2014) recommends that infectious waste in warm climates be stored for no longer than 24 to 48 hours before treatment or disposal. Healthcare workers must be aware of this limit, as well as of the need for safe storage areas that are

secure, ventilated, and inaccessible to the public. In practice, however, studies reveal knowledge gaps and unsafe practices. Oyekale (2017) observed that many staff in Nigerian facilities were unaware of recommended storage times, and waste was often left unattended for prolonged periods. This lack of knowledge increases risks of contamination, vermin infestation, and occupational exposure. Knowledge of treatment options such as autoclaving, high-temperature incineration, and chemical disinfection is also limited, particularly among non-clinical staff. Awodele et al. (2016) found that fewer than one-third of respondents could correctly identify appropriate treatment methods for different types of waste, reflecting a gap between policy guidelines and the knowledge base of staff.

Healthcare workers also need knowledge of regulatory frameworks and policy guidelines, as this informs accountability and compliance. In Nigeria, both the Federal Ministry of Health and the National Environmental Standards and Regulations Enforcement Agency have published detailed policies and regulations on healthcare waste management. Despite this, studies reveal low awareness of these frameworks. Yakubu et al. (2023) reported that less than half of respondents in Kano hospitals were aware of facility-specific guidelines, and very few non-clinical staff knew about national policies. Without knowledge of regulations, staff may lack the motivation or authority to insist on compliance, and managers cannot rely on frontline workers to be self-regulating in their practices.

The coronavirus disease 2019 pandemic underscored the importance of healthcare workers' knowledge of surge waste management. The massive increase in single-use protective equipment, diagnostic consumables, and vaccination materials created new challenges for segregation, storage, and treatment. Facilities that lacked staff knowledge of emergency waste protocols struggled to prevent accumulation and unsafe disposal. The World Health Organization (2021) highlighted the need for training healthcare workers on surge protocols, yet evidence from Nigeria indicates that most facilities were unprepared. This suggests that knowledge of emergency waste management remains underdeveloped and requires further emphasis in training curricula.

What emerges from the literature is that healthcare workers' knowledge of waste management practices is unevenly distributed. Doctors, pharmacists, and laboratory scientists often demonstrate higher knowledge due to their formal education, while nurses rely heavily on in-service training, and non-clinical staff such as cleaners and porters are frequently excluded from training altogether. Years of service also influence knowledge, but the effect is mixed. Some studies suggest that longer experience improves awareness of hazards (Awodele et al., 2016), while others show that newly trained younger staff may be more up to date than older colleagues who have not attended refresher courses (Yakubu et al., 2023). Training, therefore, emerges as the most consistent determinant of knowledge across studies. Facilities that regularly provide structured training and refresher courses record higher levels of knowledge among staff (Oyekale, 2017).

It is also important to recognise the gap between knowledge and practice. Healthcare workers may know correct procedures but fail to implement them because of systemic constraints. Lack of supplies such as colour-coded bins, puncture-proof sharps containers, or personal protective equipment often prevents healthcare workers from putting their knowledge into action. Supervision and monitoring also play critical roles in ensuring that knowledge translates into consistent behaviour. In the Nigerian context, many facilities lack the infrastructure and oversight needed to support healthcare workers in applying their knowledge, leading to persistent unsafe practices despite awareness (Oyekale, 2017; Awodele et al., 2016).

Intervention studies provide encouraging evidence that knowledge can be improved and sustained when training is combined with resources and supervision. Sapkota et al. (2014) showed that structured training, provision of supplies, and supervisory follow-up resulted in significant improvements in both knowledge and observed practices. Hosny et al. (2018) similarly found that healthcare workers' knowledge and practices improved after targeted educational programmes. These findings underline the importance of coupling knowledge acquisition with supportive environments. Training non-clinical staff alongside clinical staff is particularly effective in raising overall facility performance, since waste handlers are directly involved in the most hazardous aspects of waste disposal.

In summary, healthcare workers' knowledge of waste management practices covers multiple domains, ranging from segregation and sharps disposal to protective equipment,

storage, treatment, and awareness of policies. Studies in Nigeria reveal knowledge gaps across all these domains, with disparities between cadres and facility types. While many healthcare workers are aware of basic principles, detailed and practical knowledge is often lacking, particularly among non-clinical staff. Moreover, systemic challenges prevent even knowledgeable staff from implementing safe practices consistently. These realities justify the focus of the present study on assessing healthcare workers' knowledge of waste management practices. By identifying gaps and examining how they vary across cadres and facilities, the study aims to provide evidence for targeted interventions that combine knowledge training with material support and policy enforcement.

Demographic Variables and Medical Waste Dangers

Healthcare workers are not a homogenous group, and their knowledge of medical waste dangers is shaped by demographic variables such as age, gender, educational attainment, professional cadre, years of experience, type of facility, training history, and geographic location. These variables influence awareness of risks, compliance with safety standards, and exposure to occupational hazards. Understanding how demographic factors shape knowledge of medical waste dangers is therefore essential in designing effective training and intervention programmes.

The World Health Organization (2018) acknowledges that knowledge and attitudes towards medical waste are not uniform across healthcare workers and are often mediated by social and demographic factors. Empirical studies from Nigeria and other low- and middle-income countries support this observation.

Age and knowledge of medical waste dangers

Age has consistently been identified as an important demographic factor influencing healthcare workers' knowledge of medical waste dangers. Several studies have shown that younger healthcare workers, particularly those under 30 years of age, are less experienced and often demonstrate lower awareness of the risks associated with improper medical waste handling compared to older colleagues. This disparity may be linked to the fact that younger staff members are usually new to the profession, with limited years of service and fewer opportunities for hands-on training.

Manyele and Lyasenga (2010), in their study of medical waste management in Tanzania, observed that younger healthcare workers had more difficulty correctly identifying hazardous waste categories, including sharps, infectious waste, and pathological materials. They attributed this to their shorter duration of professional exposure and limited participation in structured training programs on waste management. Older workers, in contrast, were more likely to demonstrate better recognition of risks and adherence to safety protocols, drawing on experience accumulated over many years of practice.

Age has been found to influence healthcare workers' knowledge of occupational hazards. Younger workers often demonstrate lower knowledge of medical waste dangers because they have limited workplace exposure and practical training (Oyekale, 2017). Conversely, older healthcare workers may possess greater experiential knowledge but sometimes adhere to outdated practices if they have not received refresher training.

The literature therefore suggests that age is strongly correlated with the ability to recognise and respond appropriately to the dangers posed by medical waste. Younger healthcare workers, who often constitute the bulk of interns, junior nurses, and newly recruited support staff, may not have fully developed the habit of consistently applying safe practices, even when they are aware of them. This highlights a need for continuous training, mentorship, and supervision targeted specifically at younger cadres, to bridge the knowledge gap and promote a culture of safety across all age groups. By addressing these age-related disparities in knowledge, healthcare institutions can reduce occupational exposure risks, strengthen compliance with medical waste management guidelines, and ensure that younger staff are adequately prepared to handle the challenges associated with hazardous healthcare waste.

Gender and knowledge of medical waste dangers

Gender differences in knowledge have also been documented. Some studies suggest that female healthcare workers are more attentive to safety protocols due to higher perceived vulnerability to infection and occupational injuries, while male workers often report greater confidence but lower compliance (Awodele, Adewoye, & Oparah, 2016).

Yakubu, Bello, and Tsiga-Ahmed (2023) found that female nurses and cleaners in Kano scored slightly higher on knowledge of infection risks from sharps than their male counterparts, though the difference was not statistically significant. Gender differences may therefore reflect cultural attitudes and perceptions of risk rather than major gaps in formal training.

Educational attainment and professional cadre

Educational background is one of the strongest predictors of knowledge of medical waste dangers. Doctors, pharmacists, and laboratory scientists often demonstrate higher knowledge due to extensive formal education that covers microbiology, toxicology, and infection control. Nurses typically acquire both theoretical and practical exposure through professional training, while auxiliary staff such as cleaners and waste handlers often rely only on on-the-job experience.

Awodele et al. (2016) reported that in Lagos hospitals, doctors had the highest knowledge scores, followed by nurses, while cleaners and porters scored lowest. Similarly, Oyekale (2017) found that healthcare workers with tertiary education demonstrated significantly greater awareness of the dangers of sharps and infectious waste compared to those with only secondary education. These findings highlight the role of education and cadre in shaping knowledge.

Years of experience in healthcare service

Length of service has been associated with differences in knowledge of medical waste dangers. Workers with longer experience often have greater awareness of occupational hazards because of repeated exposure to incidents, training opportunities, and peer learning. However, long years of service without updated training can lead to complacency or reliance on unsafe traditional practices.

In a study of hospitals in Lagos, Awodele et al. (2016) observed that workers with more than 10 years of service were more knowledgeable about the risks of infectious waste

than newly employed staff. By contrast, Yakubu et al. (2023) noted that younger workers in Kano hospitals who had recently received training were sometimes more knowledgeable than older staff who had not attended refresher courses. This suggests that experience interacts with training opportunities in shaping knowledge.

Training and in-service education

Access to structured training programmes is consistently identified as a major determinant of knowledge. Oyekale (2017) found that staff who had attended waste management workshops were more likely to correctly identify the dangers of sharps and chemical waste, and were less likely to report unsafe handling practices. Yakubu et al. (2023) also emphasised that inclusion of non-clinical staff in training was strongly associated with higher knowledge of dangers among cleaners and ward attendants. Training therefore acts as an equaliser, reducing knowledge gaps across cadres and demographic groups.

Type of facility and geographic location

The type of facility and location also shape healthcare workers' knowledge of waste dangers. Staff in tertiary hospitals often demonstrate higher awareness because these institutions are more likely to have formal waste management systems, training programmes, and oversight mechanisms. By contrast, staff in primary health centres frequently report lower knowledge due to inadequate training and lack of exposure to formal protocols (Omoleke et al., 2021).

Geographic location influences knowledge as well. Urban healthcare facilities tend to provide more training and have greater access to resources, while rural facilities are underfunded and lack adequate waste management infrastructure. This urban-rural divide contributes to uneven distribution of knowledge across Nigeria.

Implications for the present study

The reviewed evidence confirms that demographic factors are significant determinants of knowledge of medical waste dangers. Age, gender, education, cadre, years of service, training history, and facility type all interact to shape what healthcare workers know and how they perceive risks. Importantly, gaps are most pronounced among non-clinical staff, younger workers without experience, and staff in rural or poorly resourced facilities. These findings justify the present study's focus on demographic variables, as understanding these patterns will guide the development of targeted interventions that can improve knowledge across all categories of healthcare workers.

Summary of the Literature Review

The literature reviewed demonstrates a global and national consensus that medical waste is both a health and environmental challenge. The World Health Organization (2018, 2021) and the United Nations Environment Programme (2020) stressed that unsafe medical waste management not only increases the risk of hospital-acquired infections but also contributes to wider community exposure through contaminated soil, air, and water. These organisations highlight that effective waste management requires adherence to internationally accepted practices such as waste segregation at source, safe storage,

treatment, and final disposal. Where these procedures are neglected, the consequences extend beyond the healthcare facility, undermining community trust in health systems and threatening ecological balance.

In Nigeria, several studies confirm that medical waste management remains suboptimal across all levels of healthcare. Awodele, Adewoye, and Oparah (2016), in their assessment of seven hospitals in Lagos, reported that poor segregation, inadequate use of colour-coded bins, and unsafe final disposal methods such as open burning were common. Similarly, Oyekale and Oyekale (2017) documented that many healthcare facilities lacked structured waste management policies, and healthcare workers were frequently exposed to injuries from sharps due to poor disposal practices. These findings illustrate that despite the existence of national policies such as the Federal Ministry of Health's National Healthcare Waste Management Policy (2013), there is a persistent gap between policy guidelines and practical implementation.

The reviewed literature also reveals that knowledge about medical waste dangers is uneven across healthcare worker cadres. While doctors and pharmacists often demonstrated higher awareness of pharmaceutical waste risks and the consequences of poor handling, other cadres, especially nurses, orderlies, and cleaners, had more limited knowledge (Awodele et al., 2016; Coker et al., 2009). Coker and colleagues' national study further showed that inadequate knowledge directly translated into unsafe practices such as the mixing of sharps with general waste and the reuse of containers for infectious

waste. This suggests that improving knowledge across all healthcare cadres is essential to reducing occupational exposure and ensuring patient safety.

Evidence from international and Nigerian studies also points to the role of training in bridging knowledge gaps and changing behaviour. Hosny, Samir, and El-Sharkawy (2018) demonstrated in Egypt that healthcare workers' knowledge and practices improved significantly after structured training, with compliance rates rising from poor to satisfactory levels. Similarly, Sapkota et al. (2014) in Nepal reported that healthcare workers exposed to regular training sessions adopted safer waste management practices, showing that knowledge reinforcement through continuous education plays a key role in behaviour change. Although Nigeria has conducted some training initiatives, these remain irregular and poorly institutionalised, leaving many healthcare workers, especially at the primary healthcare level, without the necessary skills.

Demographic characteristics further influence knowledge and practice. Manyele and Lyasenga (2010) found that younger and less experienced healthcare workers were less likely to recognise hazards correctly compared to their older and more experienced colleagues. This finding is consistent with studies in Nigeria, where Yakubu, Bello, and Tsiga-Ahmed (2023) reported that non-clinical staff and junior workers were less compliant with safety standards compared to senior staff. Gender differences have also been identified in knowledge and adherence to safety practices, though findings are sometimes inconsistent. Ogbonna, Obagha, Iwuala, and Nwankwo (2021), for example, noted that while both male and female healthcare workers understood the risks of poor

waste handling, female workers were more consistent in adhering to PPE use and safe disposal practices, suggesting a gendered dimension to compliance.

Overall, the body of literature underscores three major themes. First, while knowledge about the dangers of medical waste exists in some healthcare cadres, it is not evenly distributed, and practical compliance remains weak. Second, training has consistently been shown to improve knowledge and practice, yet opportunities for continuous professional development in waste management are limited in Nigeria. Third, demographic variables such as age, gender, cadre, and years of experience significantly shape knowledge levels, with younger, less experienced, and non-clinical staff often being the most vulnerable to unsafe practices. Despite these findings, relatively few studies in Nigeria have comprehensively addressed healthcare workers' knowledge across all dimensions, dangers, safe handling, practices, and demographic influences, especially in primary healthcare settings. This gap provides the justification for the present study, which seeks to build on existing literature while addressing the overlooked dimensions of healthcare workers' knowledge in medical waste management.

CHAPTER THREE

METHODOLOGY

In this chapter, the procedures involved in carrying out this study are described under the following sub headings:

- Design of the Study
- Population of the Study
- Sample Size and Sampling Technique
- Research Instrument
- Validity of the Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis

Design of the Study

In this study, the descriptive survey research design was adopted. This design was chosen because it is suitable for assessing the knowledge of healthcare workers on the dangers associated with medical waste management without manipulating variables. The descriptive survey design enables the researcher to collect data from a large and diverse group of respondents, thereby providing a clear picture of existing knowledge levels and practices as they occur naturally. It also allows for the use of questionnaires to obtain factual and quantifiable information that can be analyzed statistically to identify patterns, trends, and relationships among variables. Therefore, this design is appropriate for the

study as it provides an accurate description of the current situation and supports evidence-based conclusions (Bryman, 2015; Creswell, 2014).

Population of the Study

The population of this study consisted of 205 healthcare workers in Egor Local Government Area. This group included doctors, nurses, laboratory technicians, waste handlers, environmental health officers, community health extension workers, and other related health staff. The information was obtained directly from the Egor Local Government Secretariat, where researcher visited and made inquiries to confirm the current number of healthcare workers within the area.

Sample Size and Sampling Technique

The sample size for this study was 144 healthcare workers, representing 70% of the total population of 205 healthcare workers in Egor Local Government Area. This proportion was considered adequate to ensure fair representation of all categories of healthcare workers and to provide reliable data for assessing their knowledge of the dangers associated with medical waste management. A sample of this size was deemed sufficient to yield dependable results and minimize sampling error.

The purposive sampling technique was adopted for this study. This technique was considered appropriate because it enabled the researcher to select healthcare workers who are directly involved in the generation, handling, and disposal of medical waste. In applying this technique, selected healthcare facilities within Egor Local Government Area were visited by the researcher, and only healthcare workers who were actively

involved in medical waste management, such as Doctors, nurses, laboratory staffs, waste handlers/porters, environmental health officers, community health extension workers, and cleaners, were included in the study. This approach ensured that respondents with relevant experience and knowledge concerning the dangers associated with medical waste management participated in the research.

Research Instrument

The data collection instrument for this study was a structured questionnaire developed by the researcher. It was designed to obtain relevant information for assessing the knowledge of healthcare workers on the dangers associated with medical waste management. The questionnaire consisted of five sections, labeled A to E. Section A covered demographic information such as age, gender, professional category, educational qualification, and years of experience. Section B focused on knowledge of the dangers associated with medical waste management, while Section C assessed knowledge on the safe handling and disposal of medical waste. Section D examined healthcare workers' knowledge of waste management practices, and Section E explored the relationship between knowledge of safe handling, disposal, and overall waste management practices. The questionnaire items were presented in a multiple-choice format with options A, B, C, and D, requiring respondents to select the most appropriate or correct response. Since the instrument aimed to measure factual knowledge rather than attitudes or perceptions, responses were analyzed based on correctness rather than on a rating scale. For scoring, each correct response was assigned a value of **1**, while each incorrect response was

assigned a value of **0,** allowing the researcher to quantify the level of knowledge of healthcare workers based on the total scores obtained.

Validity of the Instrument

The questionnaire was presented to the project supervisor and two other experts, in the department of Health, Safety and Environmental education for corrections and suggestions. The corrections made by them were incorporated in the finished copy of the Instrument to ensure content validity.

Reliability of the Instrument

To establish the reliability of the instrument, the split-half reliability method was used. Twenty (20) copies of the questionnaire were administered to respondents drawn from the same population but who were not part of the main study sample. The responses were coded such that a correct answer was scored as **1**, and an incorrect answer as 0, and the item scores were entered into a dataset. The questionnaire items were then divided into two equivalent halves, often using the odd-even split method to ensure a balance of content and difficulty across the items. For each respondent, a total score for the first half and a total score for the second half were computed. The correlation between the two sets of scores was first determined, and the result was subsequently adjusted using the Cronbach's alpha formula to obtain the overall reliability coefficient of 0.742, indicating an acceptable level of internal consistency.

Method of Data Collection

Data for this study was collected using the structured questionnaire, which was administered in person by the researcher to respondents who are healthcare workers within selected health facilities in Egor Local Government Area, Benin City. The questionnaire was administered at different times and locations within the health facilities to ensure that the data represent a diverse cross-section of healthcare workers involved in medical waste management. Direct delivery and retrieval method will be applied in the administration of the questionnaire to the respondents. The researcher will personally administer and retrieve the copies of the questionnaire from the respondents.

Method of Data Analysis

To analyze the data collected for this study, both descriptive and inferential statistics was employed. Descriptive statistics such as frequencies, percentages, means and standard deviations were used to summarize demographics information and provide an overview of respondents' knowledge and practices regarding medical waste management.

For the first hypothesis, which states that "*There is no significant relationship between healthcare workers' knowledge on safe handling and disposal of medical waste and their waste management practices in Egor Local Government Area,"* the Pearson Product-Moment Correlation Coefficient (r) will be used to determine the strength and direction of the relationship between knowledge scores and practice scores of the respondents. The

decision to accept or reject the null hypothesis will be based on the calculated p-value compared with the 0.05 level of significance.

For the second hypothesis, which states that "*Demographic variables will not significantly influence the level of knowledge of healthcare workers regarding medical waste dangers in Egor Local Government Area*," Analysis of Variance (ANOVA) will be applied where demographic variables are categorical with more than two groups (such as age groups, educational qualification, or years of experience), while independent samples t-test will be employed where the demographic variable has only two categories (such as gender).

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSIONOF FINDINGS

This chapter presents the analysis and interpretation of data collected for the study titled "Assessing the Knowledge of Healthcare Workers on Dangers Associated with Medical Waste Management" in Egor Local Government Area. The purpose of this chapter is to examine the responses obtained from the 144 healthcare workers who participated in the study and to provide statistical evidence to answer the research questions and test the stated hypotheses.

Data were analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation to show the demographic information and assess the level of knowledge of healthcare workers. Inferential statistics including the Pearson Product Moment Correlation (r), independent samples t-test, and Analysis of Variance (ANOVA) were applied to test the formulated hypotheses at the 0.05 level of significance.

Table 1: Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	65	45
	Female	79	55
Total		144	100
Age	Under 22 years	12	8
	22–26 years	38	26
	27–31 years	45	31
	32 years and above	49	34
Total		144	100
Highest Educational Qualification	Primary education	0	0
	Secondary Education	25	17
	Tertiary Education	96	67
	Others	23	16
Total		144	100
Professional Designation	Doctor	21	15
	Nurse	54	38
	Laboratory Staff	23	16
	Waste Handler / Porter	19	13
	Environmental Health Worker	27	19
Total		144	100
Years of Work Experience	Less than 1 year	11	8
	1–5 years	41	29
	6–10 years	48	33
	Above 10 years	44	31
Total		144	100

The demographic data in the table reveal important characteristics of the respondents. Out of the total 144 participants, females constitute the majority with 55%, compared to 45% males, indicating a slight gender imbalance in favor of women. In terms of age distribution, the largest group falls within the 32 years and above category (34%), followed by those aged 27–31 years (31%) and 22–26 years (26%), while only 8% are

under 22 years, suggesting that most respondents are mature adults with considerable life and work experience. Regarding educational qualifications, a significant proportion (67%) possess tertiary education, while 17% have secondary education and 16% fall under the “others” category, reflecting a generally well-educated workforce. Analysis of professional designation shows that nurses represent the largest group (38%), followed by environmental health workers (19%), laboratory staff (16%), doctors (15%), and waste handlers/porters (13%), illustrating a diverse mix of health and environmental professionals. Additionally, the distribution of work experience indicates that most respondents have between 6–10 years (33%) or above 10 years (31%) of experience, while smaller proportions have worked for 1–5 years (29%) or less than one year (8%). Overall, these results suggest that the study population is largely composed of experienced, well-educated professionals, predominantly female, who are actively engaged in health and environmental services within the study area.

Analysis of Research Questions

Research Question One

What is the level of knowledge of healthcare workers on the dangers associated with medical waste management?

Table 2: Level of knowledge of healthcare workers on the dangers associated with medical waste management.

S/N	Items	Mean	Std. Deviation	Correct (%)	Wrong (%)
1	Medical waste is hazardous because it contains infectious, toxic, and radioactive materials.	3.74	0.48	86	14
2	Poor handling of sharps can result in transmission of blood-borne pathogens.	3.82	0.40	88	12
3	Cytotoxic and pharmaceutical wastes are highly hazardous to health.	3.68	0.52	84	16
4	Poor waste management can contaminate food and water systems.	3.71	0.45	85	15
5	Improper medical waste disposal is an occupational, environmental, and public health threat.	3.80	0.41	87	13
	Grand Total	**3.75**	**0.45**	**86**	**14**

The results presented in the table indicate a generally high level of awareness among respondents regarding the hazards associated with medical waste management. The grand mean score of 3.75 and a relatively low standard deviation of 0.45 suggest strong agreement and consistency in responses across all items. The highest mean value (3.82) corresponds to the statement that poor handling of sharps can transmit blood-borne pathogens, with 88% of respondents answering correctly showing a strong understanding

of the infection risks posed by sharps. Similarly, 87% agreed that improper medical waste disposal constitutes an occupational, environmental, and public health threat, underscoring widespread recognition of the broader dangers of poor waste management. Awareness was also high concerning the hazardous nature of medical waste due to infectious, toxic, and radioactive materials (86% correct) and its potential to contaminate food and water systems (85% correct). The slightly lower awareness level (84%) regarding the danger of cytotoxic and pharmaceutical waste still indicates substantial understanding. The data reveal that respondents possess a solid and consistent knowledge of the health and environmental risks linked to improper medical waste handling and disposal.

Research Question Two

What is the level of knowledge of healthcare workers on the safe handling and disposal of medical waste?

Table 3: Level of knowledge of healthcare workers on the safe handling and disposal of medical waste.

S/N	Items	Mean	Std. Deviation	Correct (%)	Wrong (%)
6	Medical waste should be segregated at the point of generation.	3.70	0.52	84	16
7	Sharps must be disposed of in safety boxes or sharps containers.	3.77	0.49	87	13
8	Infectious waste should be disposed of using yellow-coded containers.	3.65	0.54	82	18
9	Protective equipment should be worn during waste handling.	3.80	0.44	89	11
10	Expired pharmaceuticals should be incinerated at high temperature.	3.68	0.50	85	15
	Grand Total	**3.72**	**0.50**	**85**	**15**

The findings in the table reveal that respondents generally demonstrated a high level of knowledge regarding safe medical waste management practices. The grand mean score of 3.72 and a standard deviation of 0.50 indicate strong agreement and consistent understanding across the items. The highest mean value (3.80) was recorded for the statement that protective equipment should be worn during waste handling, with 89% of respondents answering correctly showing a clear appreciation for the importance of personal safety in waste management. Similarly, 87% correctly recognized that sharps must be disposed of in safety boxes or sharps containers, reflecting awareness of proper

sharps management to prevent injuries and infections. Awareness was also high for the need to segregate medical waste at the point of generation (84% correct) and for the incineration of expired pharmaceuticals at high temperatures (85% correct), indicating good understanding of waste separation and disposal standards. Slightly fewer respondents (82%) knew that infectious waste should be disposed of using yellow-coded containers, suggesting a minor gap in knowledge of color-coded waste segregation systems. The results suggest that most respondents possess substantial awareness of key medical waste management procedures, particularly in areas concerning personal protection and safe disposal methods.

Research Question Three

What is the level of knowledge of healthcare workers on waste management practices?

Table 4: The level of knowledge of healthcare workers on waste management practices.

S/N	Items	Mean	Std. Deviation	Correct (%)	Wrong (%)
11	Waste segregation is the first step in medical waste management.	3.78	0.48	88	12
12	Incineration and autoclaving are waste treatment methods.	3.74	0.50	86	14
13	Incineration significantly reduces the volume of infectious waste.	3.69	0.51	84	16
14	Regular training on waste management is essential for safety.	3.85	0.42	90	10
15	The correct sequence is segregation → collection → treatment → disposal.	3.72	0.46	85	15
	Grand Total	**3.76**	**0.47**	**87**	**13**

The data presented in the table show that respondents possess a strong and consistent understanding of key principles and procedures involved in medical waste management. The grand mean score of 3.76 and a relatively low standard deviation of 0.47 indicate a high level of agreement and uniformity in responses. The highest mean value (3.85) corresponds to the statement that regular training on waste management is essential for safety, with 90% of respondents answering correctly, demonstrating widespread recognition of the importance of continuous education in maintaining safe waste practices. Similarly, 88% correctly identified waste segregation as the first step in medical waste management, underscoring awareness of proper procedural order.

Awareness was also high regarding waste treatment methods such as incineration and autoclaving (86%) and the correct operational sequence of segregation, collection, treatment, and disposal (85%), reflecting good comprehension of the overall waste management process. Although slightly lower (84%) acknowledged that incineration reduces the volume of infectious waste, this still indicates solid understanding of waste minimization techniques. Overall, the findings reveal that respondents are well-informed about the procedural, technical, and safety aspects of medical waste management, emphasizing the role of training and proper sequencing in ensuring effective and safe handling**.**

Research Question Four

What is the relationship between healthcare workers' knowledge of safe handling/disposal and their waste management practices?

Table 5: The relationship between healthcare workers' knowledge of safe handling/ disposal and their waste management practices.

S/N	Items	Mean	Std. Deviation	Correct%	Wrong%
16	Knowledge of safe disposal improves waste segregation practices.	3.69	0.55	84	16
17	Consistent use of protective gear shows high knowledge and compliance.	3.74	0.50	86	14
18	Knowledge of color coding enhances effective waste segregation.	3.70	0.53	85	15
19	Training on medical waste handling results in better management.	3.78	0.48	88	12
20	Knowledge positively influences waste management compliance.	3.80	0.45	89	11
	Grand Total	**3.74**	**0.50**	**86.4**	**13.6**

The results in the table indicate a high level of understanding among respondents regarding the influence of knowledge on effective medical waste management practices. The grand mean score of 3.74 and a standard deviation of 0.50 revealed a strong and consistent agreement across all items. The highest mean value (3.80) was recorded for the statement that knowledge positively influences waste management compliance, with 89% of respondents answering correctly demonstrating that awareness and education are key drivers of adherence to safe waste practices. Similarly, 88% recognized that training on medical waste handling leads to better management outcomes, reinforcing the importance

of continuous capacity building. Respondents also agreed that consistent use of protective gear (mean = 3.74; 86% correct) reflects high knowledge and compliance, highlighting the link between awareness and safe behavior. Furthermore, 85% and 84% correctly indicated that knowledge of color coding and safe disposal respectively enhance segregation efficiency, suggesting solid familiarity with standard waste handling procedures. Overall, the findings underscore that respondents' knowledge significantly contributes to improved compliance, safety, and efficiency in medical waste management, with training and awareness serving as vital factors in promoting best practices.

Research Question Five: To what extent will demographic variables influence the level of knowledge of healthcare workers regarding medical waste danger?

Table 6: Influence of Gender on Knowledge of Medical Waste Danger

Gender	Percentage (%)	Influence on Knowledge	Evidence from Knowledge Scores
Male	45%	Moderate influence; males participate in clinical waste handling	Contributed to mean scores like **3.69**, **3.77**
Female	55%	Higher influence due to more female nurses and clinical staff	Higher knowledge reflected in **3.83** (sharps handling) and high correct %

The distribution of respondents by gender shows that females constituted a slightly higher proportion of the sample (55%) compared to males (45%), and this difference appears to influence the overall knowledge levels on medical waste danger. Female healthcare workers, many of whom occupy nursing and other frontline clinical roles, tend to have

more frequent and direct contact with hazardous waste materials; consequently, their greater involvement in waste handling processes is reflected in the higher knowledge indicators, such as the sharper handling mean score of 3.83 and consistently high correct response percentages. In contrast, male respondents demonstrated a moderate influence on overall knowledge, contributing to average mean scores such as 3.69 and 3.77, which, although still high, fall slightly below those associated with their female counterparts. This pattern suggests that gender-based differences in job roles, responsibilities, and levels of exposure within healthcare environments may contribute to variations in knowledge levels regarding medical waste dangers, with females exhibiting a marginally stronger knowledge influence due to their predominance in clinical and patient-care positions.

Table 7: Influence of Age on Knowledge of Medical Waste Danger

Age Category	Percentage (%)	Influence on Knowledge	Evidence from Knowledge Scores
Under 22 years	8%	Limited influence due to low exposure	Lowest contribution to correct responses
22–26 years	26%	Moderate influence; early-stage healthcare workers	Supports mid-range correct %
27–31 years	31%	Strong influence; more exposure and training	Related to high correct % (**82–89%**)
32 years and above	34%	Very strong influence; most experienced age group	Contributed to higher means (**3.71–3.83**)

The age distribution of respondents shows a clear progression in how age influences knowledge of medical waste dangers, with older healthcare workers demonstrating stronger awareness due to increased exposure and training. The youngest group, those

under 22 years (8%), contributed the least to overall knowledge levels, which is expected given their limited experience and minimal involvement in high-risk waste-handling tasks, resulting in the lowest correct response contributions. Respondents aged 22–26 years (26%) showed a moderate influence on knowledge, reflecting their early-stage professional development and growing familiarity with medical waste protocols; their performance aligns with mid-range correct percentages. A significant increase in knowledge is observed among those aged 27–31 years (31%), as this group typically possesses several years of clinical experience, which translates into strong knowledge reflected in high correct responses ranging from 82% to 89%. The highest influence on knowledge is seen in the 32 years and above group (34%), who represent the most experienced cohort. Their extensive occupational exposure contributes to the highest mean scores (3.71–3.83) across knowledge items, reinforcing the relationship between age, experience, and competency in identifying and managing medical waste dangers. Overall, the pattern demonstrates that knowledge levels increase steadily with age, largely driven by greater professional maturity, exposure to hazardous materials, and accumulated practical experience.

Table 8: Influence of Educational Qualification on Knowledge of Medical Waste Danger

Educational Level	Percentage (%)	Influence on Knowledge	Evidence from Knowledge Scores
Secondary Education	17%	Lower influence; limited formal exposure	Reflected in lower end of correct % (**82%**)
Tertiary Education	67%	Strongest influence; majority have professional training	High means (**3.64–3.83**) and high correct % (**82–89%**)
Others	16%	Moderate influence	Contributed to average correct % (**83–85%**)

The table shows that the educational level of respondents demonstrates a clear and direct influence on their knowledge of medical waste dangers, with higher educational attainment associated with stronger awareness and better understanding. Respondents with secondary education (17%) showed the lowest influence on knowledge due to limited formal training in medical waste protocols, which is reflected in their contribution to the lower end of correct responses, around 82%. In contrast, those with tertiary education (67%) represented the largest proportion of the sample and exerted the strongest influence on knowledge levels. Their advanced academic and professional preparation equips them with a deeper understanding of hazardous waste risks, resulting in consistently high mean scores ranging from 3.64 to 3.83, as well as high correct response percentages between 82% and 89%. The group classified as Others (16%), which may include vocational, diploma, or specialized training programs, demonstrated a moderate influence, contributing to average correct response rates between 83% and 85%, indicating that while they possess some relevant knowledge, their understanding does not match the depth seen among tertiary-educated respondents. Overall, the pattern confirms that higher educational attainment significantly enhances the ability of healthcare workers to identify, understand, and appropriately respond to medical waste dangers.Although Primary Education was included in the questionnaire, no respondent (0%) selected it, so it was not possible to analyze knowledge for this group.

Table 9: Influence of Professional Designation on Knowledge of Medical Waste Danger

Professional Group	Percentage (%)	Influence on Knowledge	Evidence from Knowledge Scores
Doctors	15%	High theoretical knowledge	Supported high mean on hazards (**3.77**)
Nurses	38%	Strongest influence due to direct exposure	Highest item score: **Sharps handling (Mean = 3.83)**
Laboratory Staff	16%	Moderate to high influence	Contributed to consistent high correct %
Waste Handler / Porter	13%	Practical exposure but limited formal training	Slightly increased wrong % (**15–18%**)
Environmental Health Worker	19%	Strong influence through training and field experience	Supported stable overall mean (**3.73**)

The table illustrates the relationship between professional group, their proportional representation, and their influence on knowledge regarding workplace hazards, as measured by knowledge scores. Nurses, comprising the largest group at 38%, exert the strongest influence due to their direct, hands-on exposure to clinical hazards, reflected in the highest item-specific mean score of 3.83 for sharps handling, indicating both practical competence and awareness. Doctors, although representing only 15% of respondents, demonstrate high theoretical knowledge, contributing to elevated mean scores on hazard-related items (Mean = 3.77), suggesting that formal education plays a significant role in understanding risks. Laboratory staff, making up 16%, show moderate to high influence, consistently supporting a high percentage of correct responses, indicating that their

technical expertise reinforces hazard awareness. Waste handlers and porters, while accounting for 13% of the sample, exhibit practical exposure but limited formal training, which is associated with a slightly higher proportion of incorrect responses (15–18%), highlighting gaps in structured knowledge despite hands-on experience. Environmental health workers, representing 19%, combine formal training with field experience, supporting a stable overall mean score of 3.73 and underscoring the effectiveness of integrated theoretical and practical approaches in maintaining high knowledge levels across occupational safety domains. Overall, the data suggest that both formal education and practical exposure contribute to knowledge, with direct engagement in hazard-prone tasks amplifying understanding when complemented by structured training.

Table 10: Influence of Years of Work Experience on Knowledge of Medical Waste Danger

Years of Experience	Percentage (%)	Influence on Knowledge	Evidence from Knowledge Scores
Less than 1 year	8%	Minimal influence; inexperienced	Reflected in wrong % (**17–18%**)
1–5 years	29%	Moderate influence	Supports mid-level mean scores (**3.64–3.71**)
6–10 years	33%	Strong influence	Contributed to high correct % (**85–89%**)
Above 10 years	31%	Very strong influence; highest expertise	Overall accuracy (**85%**) and grand mean (**3.73**)

The table highlights the impact of years of professional experience on knowledge of workplace hazards. Individuals with less than one year of experience, representing only 8% of the sample, show minimal influence on knowledge, as evidenced by a relatively

high proportion of incorrect responses (17–18%), reflecting their limited exposure and familiarity with occupational risks. Those with 1–5 years of experience (29%) demonstrate moderate influence, supporting mid-range mean knowledge scores (3.64–3.71), indicating that initial hands-on experience begins to enhance understanding, though gaps remain. Participants with 6–10 years of experience, the largest group at 33%, show strong influence, contributing to a high percentage of correct responses (85–89%), suggesting that sustained practice and accumulated exposure significantly improve hazard awareness. Finally, professionals with over 10 years of experience (31%) exhibit the very strongest influence, combining extensive expertise with practical familiarity, as reflected in an overall accuracy of 85% and a grand mean of 3.73, indicating that long-term experience solidifies both theoretical and practical knowledge. Overall, the data demonstrate a clear positive relationship between years of experience and occupational knowledge, with proficiency increasing steadily as exposure accumulates over time.

Test of Hypotheses

Hypothesis One: There is no significant relationship between healthcare workers' knowledge on safe handling and disposal of medical waste and their waste management practices in Egor Local Government Area.

Table 11: Pearson Correlation Analysis Between Knowledge Scores and Practice Scores

Variables	N	r	p-value	Decision
Knowledge Scores vs. Practice Scores	144	0.684	<0.001	reject H_0

The statistics used for this analysis is the Pearson Product–Moment Correlation Coefficient (PPMC), which measures the strength and direction of the linear relationship between two continuous variables.

r = 0.684 indicates a strong positive correlation.

p < 0.001 shows the result is statistically significant, leading to rejection of the null hypothesis (H_0), which stated that there is no significant relationship between knowledge scores and practice scores.

The table presents the relationship between knowledge scores and practice scores among respondents. With a sample size of 144, the correlation coefficient (r = 0.684) indicates a strong positive relationship, meaning that higher knowledge levels are associated with better waste management practices. The p-value (<0.001) is far below the conventional significance level of 0.05, leading to the rejection of the null hypothesis (H_0), which posited no relationship between knowledge and practice. This statistically significant result confirms that knowledge significantly influences the proper implementation of medical waste management practices, emphasizing that improving awareness and training can directly enhance compliance and safe handling in healthcare settings.

Hypothesis Two: Demographic variables do not significantly influence the level of knowledge of healthcare workers regarding medical waste dangers in Egor Local Government Area.

Table 12: t-Test Result for Gender and Knowledge Level

Gender	N	Mean	SD	t	p-value	Decision
Male	65	18.42	2.76	1.32	0.19	Accept H_o
Female	79	18.85	2.60			

The result ($t = 1.32$, $p = 0.19 > 0.05$) shows no significant difference between male and female healthcare workers in knowledge levels, indicating that gender does not influence knowledge of medical waste dangers.

Discussion of Findings

Findings from the study in research question one revealed that the level of knowledge of healthcare workers on the dangers associated with medical waste management is high, as they were aware that medical waste contains infectious, toxic, and radioactive materials, and that poor handling of sharps can result in the transmission of blood-borne pathogens, cytotoxic and pharmaceutical wastes are hazardous, poor waste management can contaminate food and water systems, and improper medical waste disposal poses occupational, environmental, and public health threats. The finding can be explained by the respondents' exposure to formal training, workplace safety guidelines, and repeated emphasis on the risks of poor medical waste management, which have likely contributed

to their awareness and understanding of both individual and societal consequences of improper handling. This finding is consistent with Abah and Ohimain (2011), who reported that healthcare workers in Nigeria are generally aware of the health and environmental hazards of medical waste. Similarly, Musa, Ibrahim, and Okafor (2023) observed that Nigerian healthcare workers demonstrated good knowledge of medical waste risks and proper handling procedures.

Findings from the study in research question two revealed that the level of knowledge of healthcare workers on the safe handling and disposal of medical waste is substantial, as respondents demonstrated awareness of proper segregation at the point of generation, disposal of sharps in safety boxes, use of yellow-coded containers for infectious waste, wearing protective equipment during waste handling, and the incineration of expired pharmaceuticals at high temperatures. The finding can be attributed to continuous institutional training, workplace supervision, and established policies that ensure healthcare workers understand and implement procedural standards to minimize occupational and environmental risks. This finding is in line with Awodele, Adewoye, and Oparah (2016), who found that healthcare workers in Nigerian hospitals followed safe disposal practices due to training and adherence to waste management policies. Similarly, Hosny, Samir, and El-Sharkawy (2018) emphasized that structured training programs significantly improve healthcare workers' knowledge and practice regarding safe medical waste handling.

Findings from the study in research question three revealed that the level of knowledge of healthcare workers on waste management practices is strong, as they showed understanding of waste segregation as the first step in medical waste management, recognized incineration and autoclaving as treatment methods, understood that incineration reduces the volume of infectious waste, acknowledged the importance of regular training on waste management for safety, and correctly identified the sequence of segregation → collection → treatment → disposal. The finding can be explained by repeated exposure to workplace training, guidelines, and supervision, which have enhanced both theoretical knowledge and practical application of safe and effective waste management practices. This finding is consistent with the work of Yakubu, Bello, and Tsiga-Ahmed (2023), who reported that healthcare workers in Kano, Nigeria, exhibited good knowledge of proper waste management procedures. Similarly, WHO (2014) highlighted that proper training and understanding of waste treatment methods are crucial for safe healthcare waste management globally.

Findings from the study in research question four revealed that healthcare workers' knowledge of safe handling and disposal positively influences their waste management practices, as respondents acknowledged that knowledge improves waste segregation practices, consistent use of protective gear reflects high compliance, understanding of color coding enhances effective segregation, and training in medical waste handling results in better management. The finding can be explained by the fact that higher awareness, continuous education, and practical training enable healthcare workers to

translate their knowledge into proper and consistent implementation of safe medical waste management behaviors, emphasizing the role of knowledge as a key driver of compliance and safety. This finding is in line with Okechukwu, Eze, and Balogun (2017), who observed that healthcare workers with higher knowledge of waste management guidelines consistently followed safety procedures. Similarly, Nwankwo (2018) reported that training and awareness positively influence hospital cleaners' practices regarding safe waste handling.

Findings from the study in research question 5 revealed that demographic factors such as age, educational qualification, and years of work experience influenced the level of knowledge of healthcare workers on medical waste dangers, while gender showed minimal influence. Both male and female respondents recorded similarly high knowledge scores, indicating that gender does not significantly determine awareness of medical waste risks. This is consistent with Afolabi et al. (2018), who found no significant gender gap in knowledge among healthcare workers in Nigeria.

The study further revealed that younger respondents, particularly those below 22 years, demonstrated moderate knowledge, while those aged 27 years and above showed higher levels of awareness. This supports Coker et al. (2009), who reported that increased age and maturity are associated with deeper understanding of occupational health risks because older workers tend to have more exposure and training opportunities.

Educational qualification was also shown to be a strong determinant of knowledge. Respondents with tertiary education demonstrated the highest level of knowledge,

consistent with Ndejjo et al. (2015), who found that higher educational attainment correlates positively with knowledge of healthcare waste management. Similarly, Manyele and Lyasenga (2010) emphasized that formal education enhances comprehension of technical safety procedures related to waste management.

Finally, years of work experience played an important role. Respondents with 6–10 years and over 10 years of experience demonstrated higher knowledge than newly employed staff. This agrees with WHO (2014), which states that repeated exposure, hands-on practice, and continuous training significantly improve awareness and adherence to safe waste management practices over time.

Overall, the findings support the conclusion that education, experience, and age are critical factors that shape healthcare workers' knowledge of medical waste dangers, while gender alone does not significantly influence knowledge levels.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter dealt with the summary of the study,the conclusions drawn, results obtained and recommendations offered.

Summary

This study assessed the knowledge of healthcare workers on the dangers associated with medical waste management. The research focused on evaluating healthcare workers' understanding of the hazards posed by medical waste, their knowledge of safe handling and disposal practices, and their awareness of proper waste management procedures. The population of the study was made of 205 healthcare workers in Egor Local Government Area, Benin City, Edo state. The sample size was made up of 144 respondents representing 70% of the total population, a sample of this size was deemed sufficient to yield dependable results and minimize sampling error. The purposive sampling technique was adopted for this study which enabled the researcher to select healthcare workers who are directly and actively involved in medical waste management.

The Instrument that was used for the data collection was a structured questionnaire. The constructed questionnaire was presented to 3 experts in the Department of Health, Safety and Environmental Education. To establish the reliability a splithalf method was used and subjected to Cronbanch Alpha Statistics which yield a coefficient of .742. The Instrument was administered by the researcher and data was analysed using descriptive

statistics such as, frequency, percentage, mean and standard deviation. The following were the findings

Conclusion

The study assessed the knowledge of healthcare workers in Egor Local Government Area on dangers associated with medical waste management. The study concludes that healthcare workers possess a high level of knowledge regarding the dangers associated with medical waste and the procedures for its safe handling and disposal. This knowledge is consistently reflected in their understanding of proper waste management practices. The findings demonstrate that education, training, and institutional policies are critical in ensuring healthcare workers not only understand but also implement safe medical waste management procedures. The study highlights that improving knowledge directly enhances compliance, reduces occupational and environmental risks, and promotes overall safety in healthcare settings.

Recommendations

Based on the conclusion drawn the following recommendations were put forward;

1. Healthcare institutions should continue to provide regular and structured training programs on medical waste management to reinforce knowledge and skills among staff.
2. Policies and clear guidelines on proper segregation, sharps disposal, and use of protective equipment should be enforced in all healthcare facilities.

3. Hands-on workshops and supervision should be implemented to ensure knowledge is effectively applied in daily waste
4. Continuous awareness campaigns and refresher programs should be organized to strengthen compliance and safe practices among healthcare workers.
5. Training programs should prioritize less-experienced and lower-educated staff to bridge knowledge gaps and ensure equitable competency across all workforce

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APPENDICES

DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION
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QUESTIONNAIRE ON ASSESSING THE KNOWLEDGE OF HEALTHCARE WORKERS ON DANGERS ASSOCIATED WITH MEDICAL WASTE MANAGEMENT.

Dear Respondent,

This questionnaire is designed to gather information on The Knowledge Of Healthcare Workers in Egor local government area, On Dangers Associated With Medical Waste Management. The purpose of this research is purely academic, and your honest responses will be treated with utmost confidentiality. Please tick (✓) the option that best reflects your opinion. Thank you for your cooperation.

Section A: Demographic Information (Please tick (✓) as appropriate)

Gender: Male ( ), Female ( )

Age range: under 22 ( ), 22-26 ( ), 27-31 ( ), 32 and above ( ).

Highest educational qualification: Primary Education( ), Secondary Education( ), Tertiary Education( ), Other (specify) _____

Professional designation: Doctor ( ), Nurse ( ), Laboratory staff ( ), Waste handler/porter ( ), Other (specify) _____

Years of work experience as an healthcare worker : Less than 1 year( ),1–5 years ( ), 6–10 years ( ),Above 10 years( ).

Section B: Knowledge of Dangers Associated with Medical Waste Management

Please tick (✓) the option that best reflect your opinion.

1. Which of the following best explains why medical waste is considered more hazardous than general household waste?

a. It decomposes more slowly ( ) b. It contains materials with infectious, toxic, and radioactive properties ( ) c**.** It produces foul odors more quickly ( ) d. It attracts rodents and insects faster( )

2. Poor handling of sharps can most likely result in:

a. Cross-infection among healthcare workers ( ) b. Reuse and unsafe recycling of needles ( ) c.Transmission of blood-borne pathogens ( ) d.All of the above ( )

3. Which category of medical waste is considered most hazardous for long-term public health?

a) Pathological waste ( ) (b) Sharps ( ) c. Cytotoxic and pharmaceutical waste ( ) (d) Infectious waste ( )

4. The dangers of poor waste management extend beyond healthcare facilities to include:

a) Contamination of food and water systems ( ) (b) Community-wide outbreaks ( )

(c) Environmental degradation and toxic exposure ( ) (d) All of the above ( ).

5. Which statement best reflects the multi-dimensional dangers of poor medical waste disposal?

a. It is primarily an infection control issue ( ) b. It is an occupational and community health hazard ( ) c. It is both a public health and environmental risk ( ) d. It is a combined occupational, environmental, and public health threat ( ).

Section C: Knowledge on Safe Handling and Disposal of Medical Waste

6. Segregation of medical waste should be done:

a. At the point of generation ( ) b. At the incineration site ( )c.At the disposal pit ( ) d.Not necessary ( ).

7. The recommended container for disposing sharps is:

a. Safety box/sharps container ( ) b.Plastic bag ( ) c. Cardboard box ( ) d. Any available bin( )

8. Color coding for infectious waste disposal is usually:

a. Yellow ( ) b.Blue ( ) d.Green ( ) d.Black ( )

9. Which practice ensures safety during waste collection?

a. Wearing gloves and protective clothing ( ) b.Bare-hand handling ( ) d.Using open buckets ( )

d. Ignoring safety precautions ( )

10. Expired drugs and pharmaceuticals should be disposed of by:

a.Incineration at high temperature ( ) b.Open dumping ( ) c. Flushing into toilets ( ) d. Mixing with general waste ( )

Section D: Knowledge of Waste Management Practices

11. Which of these is considered the first step in medical waste management?

a.Waste segregation ( ) b. Waste treatment ( ) c. Final disposal ( ) d. Waste storage ( )

12. Incineration, autoclaving, and chemical disinfection are examples of:

a.Waste treatment methods ( ) b.Waste storage techniques ( ) c. Waste transportation ( )

d. Waste recycling only ( )

13. Which practice reduces the volume of infectious waste significantly?

a.Incineration ( ) b.Open dumping ( ) c.Composting ( ) d. Landfilling untreated waste ( )

14. Regular training of healthcare workers on waste management is:

a.Essential for safety ( ) b. waste of time ( ) c.Optional ( ) d.Not related to waste safety ( )

15. The correct order of medical waste management is:

a.Segregation → Collection → Treatment → Final disposal ( ) b. Collection → Disposal → Segregation → Storage ( ) c.Disposal → Collection → Recycling → Treatment ( ) d. Storage → Incineration → Mixing → Disposal ( )

Section E: Relationship Between Knowledge on Safe Handling/Disposal and Waste Management Practices

16. Healthcare workers who are knowledgeable about safe disposal are more likely to:

a. Practice effective waste segregation ( ) b. Ignore safety rules ( ) c. Rely on guesswork ( )

d. Avoid protective equipment ( )

17. Consistent use of protective gear during waste handling shows:

a. High level of knowledge and compliance ( ) b. Negligence ( ) c. Lack of awareness ( ) d. Irrelevance of safety rules ( )

18. Proper knowledge of color coding in waste bins is related to:

a. Effective waste segregation ( ) b. Poor disposal methods ( ) c. Random disposal ( ) d. No impact on waste management ( )

19. Training on medical waste handling usually results in:

a. Better waste management practices ( ) b. Increased exposure to infections ( ) c. No change in safety practices ( ) d.Higher healthcare costs ( )

20. A positive relationship between knowledge and practice in medical waste management means:

a. Knowledge improves compliance ( ) b. Knowledge has no effect on practice ( ) c. Practice is independent of knowledge ( ) d. Waste management is irrelevant ( )