

**EFFECT OF AN EDUCATION INTERVENTION BASED ON UTILIZATION OF AN  
INDIVIDUALIZED RAPID ASSESSMENT TOOL ON KNOWLEDGE, ATTITUDE AND  
PRACTICE OF HEALTHCARE WORKERS REGARDING MEDICAL WASTE MANAGEMENT: A  
QUASI-EXPERIMENTAL STUDY AT SELECTED HEALTH CENTER III'S IN MUKONO  
DISTRICT**

**IRENE NAKAMATTE**

**RM19M11/008**

**A DISSERTATION SUBMITTED TO THE FACULTY OF PUBLIC HEALTH,  
NURSING AND MIDWIFERY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR  
THE AWARD OF A DEGREE OF MASTER OF SCIENCE IN NURSING SCIENCE OF UGANDA  
CHRISTIAN UNIVERSITY**

**May, 2024**



**UGANDA CHRISTIAN  
UNIVERSITY**

*A Centre of Excellence in the Heart of Africa*

### **Declaration**

I Irene Nakamatte, declare that the work presented in this research report is my personal work and that it has not been submitted to any other institution of higher learning or university for any academic purposes. Where other people's work has been referred to, this has been acknowledged.

Signature



Date 29-4-2024

### Approval

This dissertation has been completed under supervision. It is submitted to the Directorate of Research and Post graduate studies for examination, with our approval.

Elizabeth Namukombe Ekong (RN, PhD)

Lecturer Uganda Christian University

Mukono, Uganda

Signature



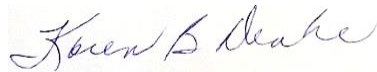
Date 29-04-2024

Karen B. Drake (RN, PhD)

Professor of Nursing, Bethel University

St Paul, MN, USA

Signature



Date 29-04-2024

### **Acknowledgement**

I register my sincere acknowledgement to my supervisors, Dr. Elizabeth Namukombe Ekong and Prof. Karen Drake, for their devoted effort, support, guidance and positive contribution to my research work. A special thanks to my dear husband, Henry Majwala (Rev.) for the support offered during this period. You are the wind beneath my wings, be blessed. My children, Eleanor, Eleazar and Enoch, thank you for being patient with me. To Dr. Faith Sebuliba, my classmates and friends, thank you so much for supporting and enlightening me during my study at Uganda Christian University. Above all, I thank the Almighty God for keeping me healthy, both psychologically and physically.

## Table of Contents

Declaration .....	ii
Approval .....	iii
Acknowledgement .....	iv
Table of Contents .....	v
List of Tables .....	ix
List of Figures .....	x
List of Acronyms .....	xi
Abstract .....	xii
Chapter One: Introduction .....	1
Background .....	2
Problem Statement .....	9
Purpose of the Study .....	10
Research Question .....	10
Objectives .....	11
Significance of Study to Nursing .....	11
Theoretical Framework .....	12
Perceived susceptibility. ....	13
Perceived severity. ....	14
Perceived threat. ....	14
Perceived benefits. ....	15
Perceived barriers. ....	15
Modifying factors. ....	15
Cues to action. ....	15
Self-efficacy. ....	16
Operationalization of Theoretical Framework to this Study. ....	17
Perceived susceptibility. ....	17
Perceived severity. ....	17
Modifying variables. ....	17
Perceived benefits. ....	17
Perceived barriers. ....	18
Perceived threat. ....	18
Self-efficacy. ....	18
Cues to action. ....	18
Study Variables .....	19
Additional Definition of Concepts .....	20
Healthcare workers. ....	20
Knowledge on medical waste management. ....	20
Attitude on medical waste management. ....	20

Practice related to medical waste management .....	21
Medical waste management.....	21
The individualized rapid assessment tool.....	21
Summary.....	22
Chapter Two: Review of Literature .....	23
Medical Waste is a Global Concern for Healthcare Workers.....	23
Standard Guidelines on Medical Waste Management Drive Practice.....	26
Healthcare Workers Face Challenges in Management of Medical waste.....	30
Knowledge on medical waste management.....	31
Attitude on medical waste management.....	32
Practice of medical waste management.....	36
Multiple Strategies Improve Management of Medical Waste .....	39
Health Belief Model is applicable to Medical Waste Management .....	42
Perceived barriers.....	42
Modifying variables to medical waste management.....	43
Cues to action.....	44
Gap this Study Addresses .....	45
Summary.....	46
Chapter Three: Methodology.....	47
Study Design.....	47
Study Setting.....	47
Study Population.....	48
Sample.....	48
Sampling Technique .....	48
Sample Size.....	49
Inclusion criteria .....	50
Data Collection Tools .....	50
Scoring the Knowledge, Attitude and Practice Questions .....	51
Knowledge.....	51
Attitude.....	52
Practice.....	52
Validity .....	53
Reliability.....	53
Data Collection Process .....	54
Pre-intervention phase.....	54
Intervention phase.....	56
Post-intervention phase.....	58
Data Control.....	59
Date Analysis .....	59
Ethical Consideration.....	60
Summary.....	61
Chapter Four: Results .....	62

Participants' Socio Demographic Data.....	62
Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on Knowledge of Healthcare Workers .....	64
Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Attitude of Healthcare Workers.....	66
Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Practice of Healthcare Workers .....	72
Summary .....	75
Chapter Five: Discussion .....	76
Socio Demographic Characteristics of Healthcare Workers .....	76
Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on Knowledge of Healthcare Workers .....	76
Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Attitude of Healthcare Workers.....	77
Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Practice of Healthcare Workers .....	78
Study Limitations.....	79
Conclusion .....	79
Recommendations.....	80
Areas for Further Study .....	81
References.....	82
Appendix A: Individualized Rapid Assessment Tool.....	95
Appendix B: Questionnaire.....	101
Appendix C: Observation Checklist .....	107
Appendix D: Permission from Dr. Sebuliba to Adapt Questionnaire.....	108
Appendix E: Informed Consent Form for Healthcare Workers.....	109
Appendix F: Lesson Plan for the Educational Intervention.....	112
Appendix G: Notes for the Education Intervention .....	117
Appendix H: Power Point .....	129
Appendix I: Brochure .....	132
Appendix J: Individual Follow-Up.....	133
Appendix K: Attitude Questions for Pre-intervention .....	134
Appendix L: Attitude Questions for Post-intervention.....	136
Appendix M: Healthcare Workers Knowledge Pre-intervention.....	138
Appendix N: Healthcare workers Knowledge Post Intervention.....	140
Appendix O: Participant Attitude Scores for Pre-intervention.....	142

Appendix P: Participant Attitude Score for Post-intervention..... 144

### List of Tables

Table 1: Socio-Demographic Characteristics of Healthcare Workers.....	64
Table 2: The Effect of an Education Intervention on Healthcare workers' Knowledge...	66
Table 3: Paired Samples Test on Knowledge.....	67
Table 4a: Effect of an Education Intervention on Health Workers' Perceived Severity and Susceptibility.....	69
Table 4b: Effect of an Education Intervention on Health Workers' Perceived Benefits of and Cues to Action.....	70
Table 4c: Effect of an Education Intervention on Health Workers' Perceived Barriers and Self-efficacy .....	71
Table 5: Paired Samples Test for Attitude.....	74
Table 6a: Effect of an Education Intervention on Observed Practice in Facility One.....	75
Table 6b: Effect of an Education Intervention on Observed Practice in Facility Two.....	76
Table 7: Paired Samples Test for Practice.....	77

**List of Figures**

Figure 1: The Health Belief Model.....15

Figure 2: The Health Belief Model applied to this study..... 19

**List of Acronyms**

AIDS-Acquired Immune Deficiency Syndrome

DHO- District Health Officer

HBM- Health Belied Model

HBV- Hepatitis B Virus

HC-Health Center

HCV-Hepatitis C Virus

HCW-Healthcare Workers

HIV- Human Immune Deficiency Virus

IRAT-Individualized Rapid Assessment Tool

MOH- Ministry of Health

UCU- Uganda Christian University

UN GEF- United Nations Global Environment Facility

USAID- United States Agency for International Development

WHO-World Health Organization

## **Abstract**

**Background/Purpose:** At least 5 million people including nurses, doctors, and laboratory workers are diagnosed with hepatitis and human immune virus, the vast majority of these occurring in low-income countries. The spread of these infections to healthcare workers can be prevented through proper medical waste management such as segregation of medical waste and disposal in color-coded bins. This study determined the effect of an education intervention based on the utilization of an Individualized Rapid Assessment Tool (IRAT) on the knowledge, attitude and practice of healthcare workers regarding medical waste management at selected Health Center III's in Mukono district. The study was guided by the Health Belief Model.

**Methodology:** A quasi experimental study design with quantitative items was used. A total of 36 healthcare workers participated in the study; these were selected by consecutive sampling approach.

**Results:** Utilizing the IRAT significantly improved the healthcare workers' knowledge ( $t = 8.40, P=.001$ ), attitude ( $t(20) = 7.422, P=.001$ ) and practice ( $t(5) = 7.9, P=.001$ ) of medical waste management.

**Conclusions:** An education intervention based on utilization of IRAT is highly effective in improving the knowledge, attitude and practice of healthcare workers regarding medical waste management.

**Recommendations:** Health facility leaders should organize regular trainings using the IRAT aiming at improving healthcare workers knowledge, attitude and practice.

**Key terms:** Individualized rapid assessment tool, healthcare workers, knowledge of medical waste management, attitude on medical waste management, practice of medical waste management.

## **Chapter One: Introduction**

Proper medical waste management is required for control of hospital acquired infections. Safe management of medical waste is a key factor in controlling and reducing hospital acquired infections. It is essential in providing a safe and pleasant environment. Appropriate management of medical waste reflects service quality of a given health facility. Utilization of medical waste management guidelines and protocols is emphasized at all times (Ministry of Health [MOH], 2013). Medical waste management guidelines and protocols are a set of policies or recommendations put in place by the World Health Organization (WHO) and Ministry of Health to help reduce harm and illness caused as a result of inappropriate management of medical waste among healthcare professionals and the nearby community. The application of medical waste management guidelines is particularly important in improving service delivery, results into better patient outcomes and increased client satisfaction (WHO, 2017). Medical waste management guidelines have however not been fully utilized (MOH, 2013). Effective medical waste management practices to minimize the risk of hospital acquired infections require appropriate use of standards (United States Agency for International Development [USAID], 2016).

The practice of medical waste management is reported to be inappropriate in Uganda (Mbabazi, 2018). Inappropriate management of medical waste is associated with increased risk of hospital acquired infections such as hepatitis B, hepatitis C and human immune virus/acquired immune deficiency syndrome (WHO, 2017) among the healthcare workers. It also puts further stress hospital budgets (MOH, 2013). An individualized rapid assessment tool (IRAT) (Appendix A) was developed by the WHO to obtain an initial indication of the level of healthcare waste management at an individual healthcare facility. The tool has been found to be

highly effective in other places where it reduced the incidence of hospital acquired infections associated with inappropriate management of medical waste. The IRAT promotes best practices and helps in the development of safety standards (WHO, 2019). Training health care workers using the individualized assessment tool resulted into excellent outcome during the post intervention period (Sapkota, Gupta & Mainali, 2014). This study will determine the effect of an education intervention based on utilization of an IRAT on knowledge, attitude and practice of healthcare workers regarding management of medical waste at selected health center III in Mukono district.

## **Background**

Medical waste originates from healthcare activities. It consists of used syringes and needles, soiled dressings, anatomic waste, laboratory samples, blood, chemicals, pharmaceuticals and radioactive materials (WHO, 2017). In Uganda, medical waste is classified into categories as highly infectious waste, infectious waste, sharps, pharmaceutical waste, and non-toxic waste (MOH, 2013). Highly infectious waste includes: placenta, extracted teeth, body parts like amputated limbs, and food from infectious patients. Used cotton and gauze, pads, and contaminated bottles of infusion fluids constitute the infectious waste. Sharps for example used cannular, used syringes and needles, used scalpel, broken glass, and ampoules of medicine are also types of infectious waste. Pharmaceutical waste comprises of the expired medicine, laboratory chemicals, and empty vials. Papers, packaging material, food items and empty bottles of drinks make up the non-hazardous waste. The management of medical waste requires hard work and carefulness. When medical waste is inadequately managed, it poses a great risk to healthcare workers, patients and the community at large (WHO, 2017).

Healthcare associated infections are a major problem in the world. Many health care workers are infected in course of managing waste generated during patient care with 5.6 million people including nurses, doctors, and laboratory workers being susceptible to health care associated infections (WHO, 2017). Each year more than 5 million health care workers are diagnosed with hepatitis and HIV (Wen-Tien, 2021). Health care associated infections have caused about one million deaths among men and women, disability and estimated \$20 billion in health care cost (WHO, 2017). In Africa, infections related to medical waste management are about twenty times higher than in developed countries (Kwikiriza, Stewart, Mutahunga, Dobson, & Wilkinson, 2019).

Waste management started with Florence Nightingale (Peterson, & Bredow, 2017). While at the military hospital, Nightingale found out that the major cause of deaths among soldiers was lack of cleanliness. Nightingale setup strategies to address the problem and concluded that cleanliness and efficient drainage were necessary to healing. In her principle of care, Nightingale documented that cleanliness prevents ill health. Since then, medical waste management has become a vital element in improving quality of care and hence improved patient outcomes.

Globally, medical waste management is a critical element during patient care (WHO, 2017). Medical waste has caused a considerable burden in developed countries, where 2 % to 3% (over one million) of health care workers and patients are infected with hospital acquired infections (Babirye, Vuzi, & Mutekanga, 2020). The high resource countries have a well-organized system for medical waste management (USAID, 2016). In addition, all healthcare workers are equipped with appropriate skills on how to segregate, transport and dispose medical waste (Wen-Tien, 2021). Health institutions have a legal responsibility to manage medical waste and the amount of generated hazardous waste is handled by staff trained to handle every type of waste (Wen-Tien, 2021). High

resource countries have set aside a budget for medical waste management which allows them to employ highly effective methods like solidification, elementary neutralization, carbon absorption, separation, filtration and evaporation (WHO, 2017).

In Europe, medical waste is appropriately segregated at the point of generation and hazardous waste is managed with strict control of air pollution. Europe has regional medical waste incinerators with improved characteristics that hinder ecological pollution (Wen-Tien, 2021). Latin America/Caribbean has put more emphasis on medical waste, on site incineration is highly recommended. However, the infrastructure is faulty and medical waste is taken into sanitary landfills for complete degradation (WHO, 2017). In North America, medical waste is managed by: burning in hospital incinerators, disposal in landfills and public sewers, sterilization by steam/gas, irradiation and chemical disinfection (WHO, 2017).

Despite of the need for medical waste management, many developing countries particularly in Africa are reluctant and have not put much attention toward medical waste management (Katusiime, 2018). Healthcare workers lack awareness on waste segregation, collection, storage, transportation and disposal procedures. Medical waste is managed using cheaper and effective methods including: incineration, land filling, and compositing. Medical waste is mainly disposed as household waste, which puts a considerable risk to healthcare workers, and the community (Akulume & Kiwanuka, 2016). African countries either have no rules and regulations concerning medical waste management or do not impose them (Babirye et al., 2020). In Africa, segregation of medical waste is still limited, healthcare workers mix hazardous waste and non-hazardous waste (WHO, 2019). The major challenges in management of medical waste are: lack of awareness and inappropriate waste management practices amongst healthcare workers (Akulume & Kiwanuka, 2016). Wafula, Musiime, & Oporia (2019) found

that management of medical waste is influenced by healthcare worker's knowledge, attitude and practice.

In Uganda the system of proper medical waste management is not well implemented. There is limited financial support from the government and other funding agencies to help health facilities manage medical waste appropriately (Katusiime, 2018). Chances are high that healthcare workers and the community might be exposed to unwanted risks including ecological pollution (Katusiime, 2018). In hospital, 92 kilograms (kg) of medical waste is generated on average, at health center IV, 42 kg, 25 kg at health center III's and 20 kg at health center II's on a daily basis (MOH, 2017). Most of the health centers lack proper medical waste management facilities and health care workers inadequately manage medical waste (Akulume & Kiwanuka, 2016). Segregation of wastes based on color codes is still inadequate, solid medical waste is mixed with sharps waste at final disposal (Kwikiriza et al., 2019). Large amounts of non-hazardous waste are mixed with hazardous waste that is, empty medicine bottles were observed to be combined with food packages (Mbabazi, 2018). This increases the cost incurred during final waste disposal. It also increases the risk of injury to healthcare workers, and the community.

According to WHO, all wastes that are combined with infectious wastes are labeled infectious even when they were originally non-infectious (WHO, 2017). Sharps mixed with other types of waste increases the risk of needle sticks and sharp injury which occur during handling of health care waste (Akulume & Kiwanuka, 2016). The MOH guidelines recommend that sharp waste should be disposed immediately in puncture resistant containers labeled with bio hazard symbol (MOH, 2018). Open burning is practiced where waste is carried to a small designated site before burning and this causes scattering which is dangerous and un-attractive (Katusiime, 2018). The WHO has developed standard guidelines to aid health care workers in medical waste management and these include: segregation, handling, storage, transportation, treatment, and disposal (WHO,

2017). Appropriate management of medical waste aims at minimizing spread of infection and reduction of accidental injury to healthcare staff, clients and the public (Mbabazi, 2018). Health care workers are motivated to follow the guidelines if: adequate infrastructure and supplies are provided, given adequate training and are supervised (Katusiime, 2018). The Ministry of Health has distributed manuals containing medical waste management practices to districts, hospitals and health centers and recommends healthcare facilities to select committees to monitor the implementation of medical waste management policies and guidelines (MOH, 2013).

The study District in Central Uganda has 32 lower-level health facilities, of these 19 are at the level of health center II, 12 at level of health center III, and one at health center IV level (District Health Staff Records, 2019). Each of these health facilities generates waste which includes: hazardous wastes for example sharps, empty medicine bottles, placenta, extracted teeth, laboratory chemicals and non-hazardous waste (Health Facility Records, 2019). Health center III's have no incinerators but use waste pits dug out side to dispose and burn medical waste. An outsourced disposal company truck goes to health facilities once weekly to collect medical waste but at times it takes long and health care workers instead burn the medical waste (Health Facility Records, 2019). Infectious waste is transported with non-infectious waste. Medical waste is methodically managed by segregation at the point of generation, safe handling, transport and appropriate disposal to lessen the danger of undesirable effects (MOH, 2013). Major systematic challenges to effective medical waste management include: lack of facilities and equipment like incinerators, color coded bins, liners and safety boxes. There is also little guidance on how waste should be managed, inadequate knowledge, ineffective implementation of standard guidelines, limited allocations, and insufficient participation of health care workers (Health Facility Records, 2019). According to the MOH guidelines, medical waste should be segregated at the point of collection, before being put in color coded bins with liners (MOH,

2013). Barriers include: unclear medical waste management procedures, and low motivation regarding management of medical waste (Mbabazi, 2018).

The district health teams together with the focal person for medical waste have tried to set up committees as per MOH guidelines (Mukono District Records, 2019). Committee members include: health facility in charges, in charge nursing services, infection control nurse, quality assurance in charge, representative from laboratory, maternity, pharmacy, dental and community (Mukono District Records, 2019). The committees coach health care workers; conduct continuous monitoring and supervision concerning management of medical waste at health facility level and make reports on a monthly basis that is submitted to the district focal person (Mukono District Records, 2019). Despite these efforts, health care workers seem reluctant concerning implementation of proper waste management and hence the infection rate of health care workers has continued to rise (Muhwezi, Kaweesa, Kiberu, & Eyoku, 2014). The health facility committee members encourage, monitor good segregation and storage practices at the facilities and this has helped to increase health care workers compliance. Only trucks licensed for transporting hazardous waste are used to transport medical waste (Katusiime, 2018). A Ugandan study reveals that health care workers' level of knowledge should be related to intention and attitude to manage medical waste if we are to improve medical waste management practices (Kwikiriza et al., 2019).

Effective waste management plans have to be designed to determine healthcare workers intent to manage medical waste as well as to influence intention (Akulume & Kiwanuka, 2016). The availability of waste management committee at health facility level would ensure adequate knowledge, attitude and practice of medical waste management amongst healthcare staff (WHO, 2017). However, studies show inappropriate knowledge, attitude, and practice of healthcare workers hence limiting proper management of medical waste (Wafula et al., 2019). No literature

in the study district has specifically considered the knowledge, attitude and practices of healthcare workers regarding management of medical waste. A study at an urban referral hospital in Uganda found out that healthcare staff considers management of medical waste as a priority during patient care but experience barriers to implementation (Katusiime, 2018). The WHO developed an individualized rapid assessment tool (Appendix A) to promote safety practices and develop safety standards regarding management of healthcare waste (WHO, 2019). The tool has been found to be effective when used to train health care workers leading to excellent outcomes regarding knowledge, attitude and practice (Sapkota et al., 2016). There is limited consideration and research on medical waste management particularly in health center III facilities of the study district. This study is to determine the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of health workers at selected health center IIIs in order to enhance effective management of medical waste in health facilities and the country. This was an interventional study where healthcare workers received training and there after participated in a one-month use of an individualized rapid assessment tool.

## **Problem Statement**

Health care associated infections have remained a great problem in the world where many health workers have been infected while managing waste generated from patients. Each year more than 5 million people including nurses, doctors, and laboratory workers are diagnosed with hepatitis and human immune virus. These contribute to one million deaths among both men and women and an estimated \$20 billion in health care costs. The WHO has developed an individualized rapid assessment tool to promote safety practices and develop safety standards regarding management of healthcare waste. The MOH Uganda has developed medical waste management guidelines and protocols. Also committees have been established at every health facility to coach health care workers and to conduct continuous monitoring and supervision concerning management of medical waste. Despite these efforts, health workers are not implementing the proper waste management practice and hence the infection rate of health workers has continued to rise. If knowledge, attitude, and practice of healthcare workers are not adequate, the magnitude of infections will remain a great burden to healthcare workers in Uganda. Studies show that individualized rapid assessment tool is highly effective in improving knowledge, attitude and practice of healthcare workers. Based on this background, it is imperative to determine the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers regarding management of medical waste at selected Health Center III's in Mukono district.

## **Purpose of the Study**

The purpose of the study was to determine the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of

healthcare workers regarding medical waste management at selected Health Center III's in Mukono District.

### **Research Question**

What is the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers regarding medical waste management at selected Health Center III's in Mukono District?

### **Objectives**

1. To identify the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge of healthcare workers regarding medical waste management at selected Health Center III's in Mukono District.
2. To determine the effect of an education intervention based on utilization of an individualized rapid assessment tool on the attitude of healthcare workers regarding medical waste management at selected Health Center III's in Mukono District.
3. To describe the effect of an education intervention based on utilization of an individualized rapid assessment tool on the practice of healthcare workers regarding medical waste management at selected Health Center III's in Mukono District.

## **Significance of Study to Nursing**

Nurses may use the study findings to utilize the individualized rapid assessment tool to ensure that medical waste is managed in a manner that protects all health workers, patients and the environment from undesirable effects which result from medical waste. Nurse leaders may use study findings to promote best practices regarding management of medical waste. Nurse leaders may use the tool to conduct trainings aiming at improving healthcare workers knowledge, attitude and practice. This may lead to safe work places and health working environment.

Nurse educators may use study findings to emphasize the utilization of an individualized rapid assessment tool during classroom instruction. This may help to improve the student knowledge, attitude and practice required for proper management of medical waste. It may also help nursing students to protect themselves and others from hospital acquired infections.

Administrators in Uganda may use the findings to organize and conduct trainings on the use of individualized rapid assessment tool to promote safety practices and develop safety standards regarding management of medical waste. It may also reduce the disease burden associated with inappropriate medical waste management. Supporting health care workers through continuous supervision and coaching may enhance safety practice.

## **Theoretical Framework**

The HBM (Figure 1) helped to predict and explain the knowledge, attitude and practices of health care workers regarding to medical waste management. The HBM was formulated in 1950s to better understand the extensive increased malfunction of tuberculosis screening programs (Stretcher, DeVellis, Becker, & Rosenstock, 1986). The models four constructs are: perceived susceptibility, perceived severity, perceived benefits and perceived barriers. Additional constructs comprise of: cues to action, motivating factors and self-efficacy (Peterson & Bredow, 2017).

# The Health Belief Model

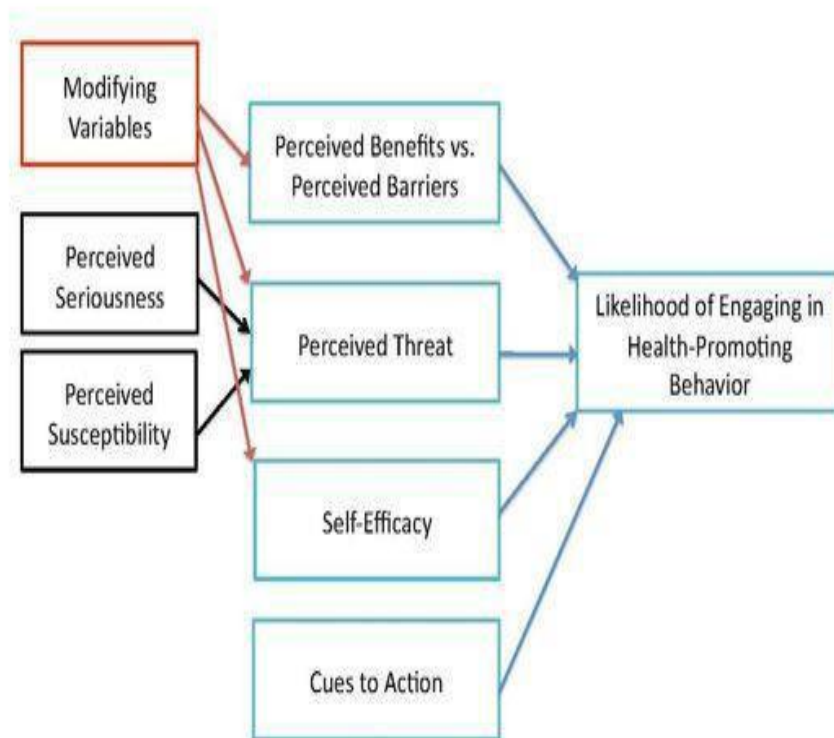


Figure 1. The Health Belief Model (Stretcher & Rosenstock, 1997, p. 76).

## Perceived susceptibility.

Refers to the subjective assessment of the danger of acquiring a health problem (Stretcher, & Rosenstock, 1997). It represents the personal view of his/her own danger of acquiring a disease state. In individuals with an already diagnosed illness, this component encompasses one's acceptance of the diagnosis, beliefs regarding disease progression and susceptibility to illness in general. According to the model, individuals who recognize that they are vulnerable to acquiring a disease condition will participate in activities to diminish the chances of contracting the problem. Individuals who are less vulnerable might refute that they are at a danger of acquiring a given illness. Some individuals might

recognize the likelihood of developing the illness but think it is not likely. Individuals who think that they are at a low risk of acquiring the disease are more liable to engage in dangerous behaviors and may not comply with the medical waste management guidelines (Glanz, Rimer, & Viswanath, 2008).

**Perceived severity.**

This refers to the subjective assessment of the seriousness of a disease condition and the possible costs (Rosenstock, 1974). Perceived severity includes beliefs about the disease or behavior itself for example it is whether it may be aggressive or may lead to disability as well as great effects of the disease on body function and social roles. Individuals who believe a high threat that will be personally affected by a given disease condition are more likely to take part in behaviors that lower the danger of developing the disease (Rosenstock, 1974). The HBM shows that persons who perceive a particular disease condition as serious are more prone to take part in behaviors to avert the disease condition from occurring or lessen its seriousness.

**Perceived threat.**

This is the combining of perceived severity and perceived susceptibility (Peterson & Bredow, 2017). Perceived seriousness and perceived vulnerability to a particular disease depends on the awareness about the disease (Rosenstock, 1974). The HBM envisage that high perceived danger results into high possibility of taking part in health promoting behaviors.

**Perceived benefits.**

This refers to a person's view of the worth of a new conduct in minimizing the threat of developing a disease (Rosenstock, 1974). The construct is often used to clarify a person's drive of a conduct and accepting an intervention or treatment.

**Perceived barriers.**

Refers to a person's appraisal of the hindrances to behavior modifications (Janz & Marsall, 1984). Perceived hindrances are beliefs about un availability, inconveniences, expense, difficulty or time-consuming nature of a health promoting behavior (Peterson & Bredow, 2017). An individual may perceive a disease condition as life intimidating and a specific intervention will successfully lessen the risk but obstacles may avert execution of a health supporting behavior. The perceived benefits must outweigh the perceived hindrances in order to alter a practice (Peterson & Bredow, 2017).

**Modifying factors.**

The four main constructs of perceptions are customized by additional variables including: ethnicity, level of awareness, previous experiences, and inspiration. Modifying factors are the personal characteristics that influence individual perceptions hence affecting health connected behaviors directly by influencing perceived seriousness, vulnerability, benefits and obstacles (Janz & Marsall, 1984).

**Cues to action.**

These are measures or proceedings that drive individuals to alter their conduct (Peterson & Bredow, 2017). Cues to action are like motivating factors, can activate the readiness and stimulate overt behavior. They can be internal or external for example institutional factors.

**Self-efficacy.**

This refers to the confidence in a person's capability to accomplish a task (Bandura, Freeman, & Lightsey, 1977). Individuals usually do not attempt to become innovative unless they believe they are able to accomplish it. If a person thinks that the innovation is useful, but does not believe he or she is competent of doing it, odds are that it will not be tried.

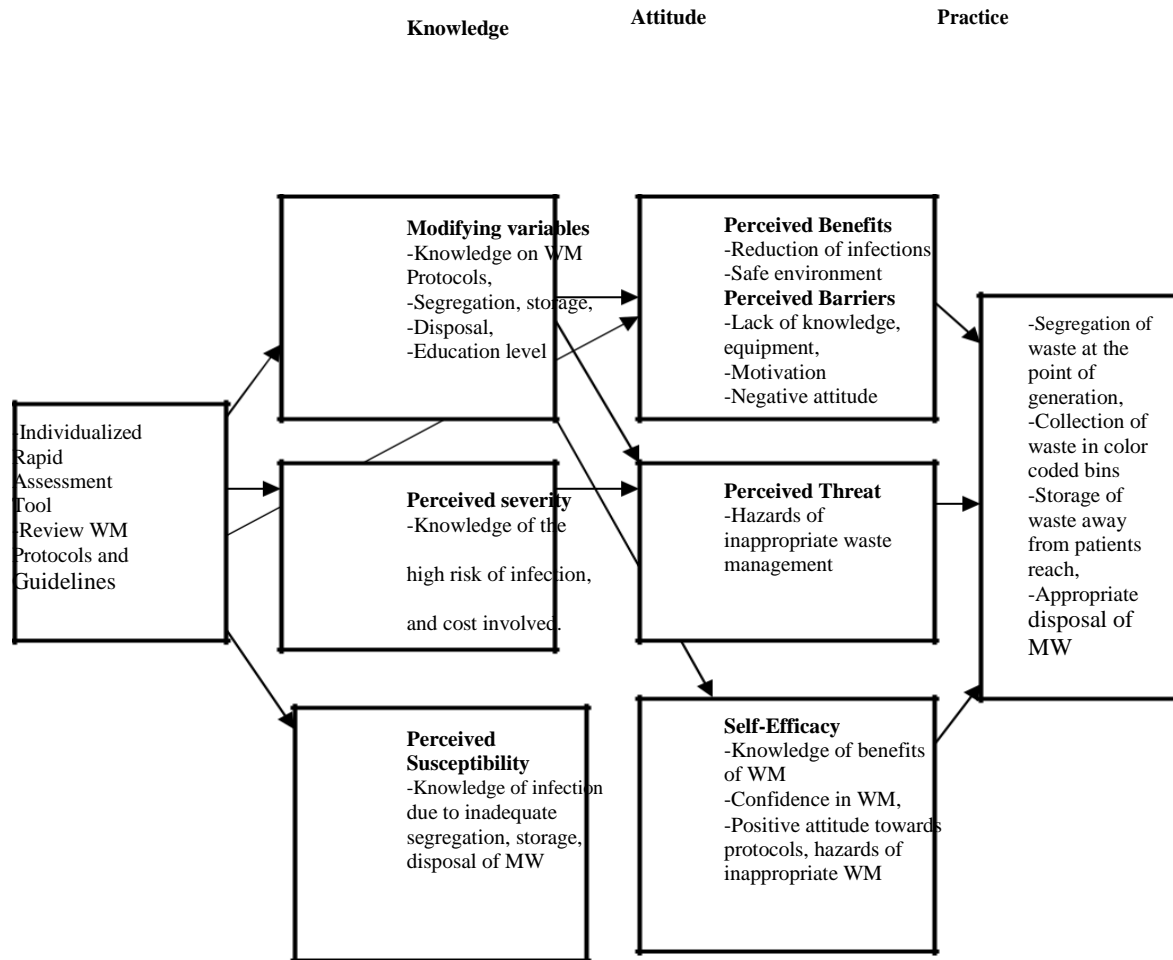


Figure 2. The Health Belief Model applied to this study

## **Operationalization of Theoretical Framework to this Study**

The health belief model was useful because of its constructs that could be used to measure the knowledge, attitude and practice of healthcare workers regarding management of medical waste. The constructs included: modifying variables, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived threat, self-efficacy and cues to action.

### **Perceived susceptibility.**

This measured the knowledge of healthcare workers on medical waste management. The key areas that were considered are: knowledge of infection due to inappropriate segregation, storage and disposal of medical waste.

### **Perceived severity.**

The construct measured knowledge of healthcare workers on medical waste management. This included knowledge of high risk of infection and cost involved if medical waste is not managed appropriately.

### **Modifying variables.**

These measured knowledge of medical waste management. They included knowledge of healthcare workers regarding the individualized rapid assessment tool, and knowledge on protocols especially in areas of segregation of waste at the point of production, storage and disposal.

**Perceived benefits.**

This construct was used to measure the attitude of healthcare workers regarding medical waste management. Benefits included: reduction of infection rate and having a safe environment.

**Perceived barriers.**

This measured the attitude of healthcare worker on medical waste management. Barriers that interfered with the safe practice of managing medical waste included: low awareness, poor attitude, lack of waste management facilities like color coded bins, liners, safety boxes and incinerators, and lack of motivation.

**Perceived threat.**

The construct measured attitude of healthcare workers regarding medical waste management. It looked at the attitude towards hazards of inappropriate medical waste management like increased risk of hospital acquired infections, absenteeism and increased cost of treatment.

**Self-efficacy.**

This measured attitude of healthcare workers. It considered the knowledge of the healthcare worker on the benefits of proper medical waste management, the confidence in managing medical waste, a positive attitude towards the individualized rapid assessment tool and the protocols, and attitude on hazards of inappropriate medical waste management.

**Cues to action.**

This was the study intervention. It involved the introduction of an individualized rapid assessment tool, teaching and coaching of health care workers on how to use the tool in order to segregate medical waste, collect waste in color coded bins, dispose waste appropriately. The health care workers were also reminded of the protocols and guidelines. The self-efficacy might have increased resulting into health care workers who are more confident and with appositive

attitude. The cues to action led to improved medical waste practices, and also reduced the cost that might be involved if medical waste was not managed appropriately. Healthcare workers became more compliant.

It was suspected that the individualized rapid assessment tool would strengthen the knowledge by applying on the modifying variables, perceived susceptibility, perceived benefits, and perceived barriers. It would also enhance the attitude by applying effect to the perceived benefits, perceived barriers, perceived threat and self-efficacy of health care workers. It was again suspected that the strengthened knowledge and enhanced attitude would improve the outcome or the practice of medical waste management. Improved practice included: segregation of medical waste at point of generation, collection of waste in color coded bins and appropriate disposal of medical waste.

### **Study Variables**

The independent variable was the utilization of an individualized rapid assessment tool. It stood alone and could not be changed by other variables in the study. The dependent variables were knowledge, attitude and practice of medical waste management. Introduction of the individualized rapid assessment tool strengthened the knowledge by applying its effect on the constructs of health belief model which included: modifying variables, perceived susceptibility, and perceived barriers. The individualized rapid assessment tool also enhanced the attitude of health care workers by reminding healthcare workers of the perceived benefits, perceived barriers, and perceived threat. The tool gave healthcare workers the self-efficacy needed to improve the practice of medical waste management.

### **Additional Definition of Concepts**

The key concepts used in the study include: individualized rapid assessment tool on medical waste management, healthcare workers, knowledge on medical waste management, attitude on medical waste management, practice related to medical waste management and medical waste management. These are defined below.

#### **Healthcare workers.**

People who engage in the promotion, protection or improvement of the health of the population (WHO, 2017). In this study, health workers are people working in health center level three; they deliver health care services to the ill directly such as clinical officers, nurses, midwives, or indirectly for example laboratory technicians.

#### **Knowledge on medical waste management.**

This refers to awareness regarding categorization, production, separation, gathering, transportation, and disposal and burning of medical waste (Calikoglu, & Aras, 2019). In this study, knowledge on medical waste management refers to the extent of awareness on importance of medical waste management, and protocol and guidelines regarding medical waste management.

#### **Attitude on medical waste management.**

The perception and internal feeling that study subjects have regarding solid, liquid and sharp waste management which may be positive or negative (Calikoglu, & Aras, 2019). In this study, attitude on medical waste management refers to the negative or positive feelings, and/or opinions toward medical waste management, protocols and guidelines.

**Practice related to medical waste management.**

Refers to the actions necessary to handle medical waste from its generation to final disposal including: gathering, transport, treatment, disposal, in addition to supervision and regulation of the waste management process (Calikoglu, & Aras, 2019). This study defines practice related to medical waste management as the segregation of waste at point of generation, collection of waste in color coded bins, storage of waste away from patients reach and appropriate disposal of medical waste.

**Medical waste management.**

This is a structure that deals with the separation, control and disposal of harmful medical waste (WHO, 2017). This study will define medical waste management as the proper separation of waste at the point of production and disposing it appropriately into different color-coded bins.

**The individualized rapid assessment tool.**

Refers to a swift appraisal means to obtain preliminary indication of the stage of medical waste management at a health unit. This leads to a general score that can be utilized by Ministries of Health contrast and grade health units for the purpose of prioritizing interventions. The individualized rapid assessment tool is a guide to determine areas of weakness (United Nations Global Environment Facility [UN GEF], 2009). In this study, the I-RAT will be introduced to the health facilities; healthcare workers will be taught how to carry out individual assessment and will be mentored for one month on the use of the tool.

## **Summary**

In this chapter, I discussed the background of the study, the problem statement, the purpose of the study, the significance of the study, the research question and objectives of the study, conceptual framework and theoretical framework. This chapter was followed by two more chapters. Chapter Two discussed literature that was reviewed. Chapter Three discussed the research methodology.

## **Chapter Two: Review of Literature**

This chapter reviewed the literature related to the study. It included literature on the way in which medical waste is a global concern for healthcare workers. There was a synthesis of the standard guidelines on medical waste management drive practice. Literature was presented that shows that health care workers face challenges in management of medical waste. There was a description of multiple strategies improve management of medical waste. Finally, the chapter analyzed literature about how the Health Belief Model is applicable to medical waste management and demonstrated the gap where this study will contribute to the concern about waste management by healthcare workers.

### **Medical Waste is a Global Concern for Healthcare Workers**

Medical waste is believed to be the second main harmful waste worldwide following radiation waste (USAID, 2016). It includes a range of wastes such as sharps, anatomical waste, blood, laboratory chemicals, and expired drugs (WHO, 2017). The waste is mainly produced by hospitals and health centers, laboratories, blood banks and nursing homes (MOH, 2013).

Globally, medical waste is jeopardizing the health of healthcare workers handling the infectious materials disposed by health facilities (MOH, 2013; Wen-Tien, 2021; WHO, 2017). Healthcare workers across the globe do not pay adequate attention to the harm caused by medical waste. About 20 to 25 percent of the entire waste produced by health facilities is considered to be infectious and creates diverse health and ecological danger if inappropriately managed. Poor medical waste management results in different hospital acquired infections, occupational health hazards and food contagion (Akulume & Kiwanuka, 2016; Babirye et al., 2020; Muhwezi et al., 2014). Mismanaged sharp waste contaminated with blood facilitates the spread of diseases such as hepatitis B, hepatitis C, HIV/AIDS and other viral diseases (Mbabazi, 2018; Wafula et al.,

2019). WHO (2017) points out that 5.6 million healthcare care workers including nurses, doctors, and laboratory workers are susceptible to health care associated infections with about 5 million diagnosed with hepatitis and human immune virus. Three million healthcare workers experience needle pricks and sharp injuries globally every year (Khalid, Haq, Sabiha, Latif, Khan, & Yousaf, 2021; Mugabi, Hattingh, & Chima, 2018; Tewabe, Tiruneh, Abej, & Walle, 2017). Health care workers are susceptible to these infections because they generate and handle medical waste during patient care delivery.

Health care associated infections have caused about one million deaths among men and women, disability and an estimated \$20 billion in health care cost (WHO, 2017). This puts a financial strain on to the families and the healthcare system at large. In Pakistan, majority of health facilities do not comply with the guidelines concerning medical waste management which exposes staff and clients (Khalid et al., 2021). Used syringes are improperly disposed especially by the janitorial staff. Sharp waste leads to cut and punctured infected wounds. Disease causing microorganisms in the hazardous waste lead to severe and grave diseases such as cholera in addition to hepatitis B, hepatitis C, and AIDS. Improperly managed medical waste is as well a medium to producing antibiotic resistant microbes. Waste from radioactive waste material may cause hearing and severe birth defects. Anatomical wastes for example placenta inappropriately disposed in plain sight causes an extremely negative visual impact to the observers (Babirye et al., 2020; Calikoglu & Aras, 2019). The WHO approximates that 8 to 16 million new cases of hepatitis B virus, 2.3 to 4.7 million cases of hepatitis C and 80,000 to 160,000 cases of HIV occur secondary to inappropriate sharp disposal and waste management systems (WHO, 2017).

The problem of medical waste management is increasing rapidly in low resource countries with fast growing healthcare services and minimal or absent technology and fiscal support to ensure appropriate medical waste management (USAID, 2016). In Africa, infections related to medical waste management are about twenty times higher than in developed countries (Chercos, Dessie, & Wami, 2018; Deress, Jemal, Girma, & Adane, 2019; Ellenkil, Varghese, & Mishra, 2021). This is because medical waste is not given the necessary attention; non-infectious waste is combined with infectious waste. Many healthcare facilities burn the hazardous medical waste which releases harmful gases and compounds toxic to the lungs of healthcare staff, clients and the public. Contaminated sharps are not segregated from the solid waste (Chercos et al., 2018; Deress et al., 2019; Ellenkil et al., 2021).

In Uganda, sharp waste is still a major cause of injuries and a transmitter of HIV and hepatitis B (Katusiime, 2018; Mbabazi, 2018; Wafula et al., 2019). Over 40 percent of sharp injuries occur during procedure, 36 percent after procedure before disposal, 15 percent associated with sharps container, and 10 percent due to improper disposal (Wafula et al., 2019). Similarly, exposure due to sharps in work places accounts for 40 percent of infection with HBV and HCV and 2-3 percent of HIV infections among health care workers (Tewabe et al., 2017). There is need to conduct training on proper medical waste management, and handling of sharps in order to promote the appropriate practice.

In summary, health care associated infections are a major problem in the world. They have caused about one million deaths among men and women, disability and estimated \$20 billion in health care cost. This puts a financial strain on to the families and the healthcare system at large. In Africa, medical waste is not given the necessary attention needed. Non-infectious waste is combined with infectious waste and sharps waste is mixed with solid waste increasing the risk of sharp injuries and associate infections. There is a need to train healthcare

workers on proper medical waste management especially the segregation, use of color codes and appropriate disposal.

### **Standard Guidelines on Medical Waste Management Drive Practice**

The latest guidelines were developed in 2013 by MOH Uganda, 2017 by WHO and have not needed to be updated. The majority of hospital acquired infections can be prevented by adequate medical waste management (MOH, 2013) for example proper segregation, use of color coding and disposal prevents 80 percent of the infections (WHO, 2017). The best way to prevent hospital acquired infections therefore is by following the standard guidelines and protocol outlined in the medical waste manual (Mbabazi, 2018; Muhwezi et al., 2014; USAID, 2016). Standard guidelines and protocols are guiding principles intended to reduce the danger of exposure to hazardous waste by healthcare workers (MOH, 2013). They include: segregation of medical waste, color coding, packaging, waste storage, waste handling, burning and incineration (MOH, 2013; WHO, 2017).

Guiding principles for proper isolation of medical waste involve: separating the dissimilar kinds of waste at the place of production, for example in treatment and dressing rooms. In addition, color coding system should be applied to all health facilities where by black color should be for non-hazardous waste, yellow for infectious medical waste, sharps and radioactive waste, red color for extremely hazardous waste, amputated body parts, placenta, and brown color for expired medicines and cytotoxic waste (MOH, 2013; WHO, 2017). When packaging medical waste, hazardous waste must be enclosed from the time of production to the time of treatment where it is made non-hazardous. Sharps must be disposed in impermeable firm, puncture-resistant containers made of glass, metal, and firm plastic or cardboard. Fluid hazardous medical waste must be sited in bottles with tight lids. Huge quantities of medical

waste could be placed containment tanks. Solid medical waste should be contained in tough, tear resistant plastic containers (MOH, 2013; WHO, 2017).

Guidelines for waste storage are that all healthcare facilities should dedicate an adequate place for storing medical waste bags, bins or containers. Health facilities should provide separate central store facilities for harmful medical waste; radioactive waste should be stored separately. Health centers at level one and two should not store highly infectious waste; this should be disposed at once. Medical waste should not be stored for more than 48 hours before treatment. Appropriately treated medical waste should be stored utmost for seven days. The selected central containment facility should be found within the health unit premises near to the treatment unit but far from kitchen, or food store, completely enclosed and protected unauthorized access. The central store must be out of way of animals, birds and insects (MOH, 2013; WHO, 2017).

Guidelines on waste handling are that disposal of medical waste should take place at the time of generation by the individual who performed a procedure. Guidelines of medical waste separation, wrapping and labeling should be made clear to all staff and posted on the walls above the waste separation containers of every unit. This aims at reminding healthcare staff of what to do. Staff who handles medical waste must put on protective gears for example face shields, aprons and heavy-duty gloves as a requirement for waste handling (MOH, 2013; WHO, 2017).

Medical waste incineration/burning translate flammable materials into inflammable remains or powder. Guidelines regarding burning include: burning should be intended for aesthetic dumping of pathological waste for example body parts and tissues. Burning must be used to make contaminated sharps unusable. Individuals concerned with burning of medical waste must put on protective shields and should be skilled with handling techniques to lessen personal exposure to harm from hazardous waste. Materials that do not need burning/incineration because their poisonous

emissions include: poly vinyl chlorinated plastics, photographic and x ray materials, mercury thermometers, batteries, heavy metals, and aerosol cans or sealed vials. To ensure safety, all burning places must be fenced to avoid entry by the animals or community. They must be situated far from residences and harvest (MOH, 2013; WHO, 2017).

Medical waste is very important in healthcare practice to minimize the risk of injury and infection spread. This can be only achieved through the implementation of the medical waste management protocols by continuously complying with the medical waste management guidelines. Strategies regarding management of medical waste have been put into place to avert and control probable health threats caused by inappropriate medical waste management. This has helped in creating a pleasing environment for healthcare workers and the community. Application of the basic standards of medical waste management as outlined in the WHO and MOH guidelines manual is important in controlling the danger of contact and consequent transmission of contamination to healthcare workers and clients (MOH, 2013; WHO, 2017).

Medical waste management guidelines have however not been fully utilized making waste management remain a serious problem. Studies on medical waste management report that health risks caused by medical waste can be minimized by having cautious planning, suitable rules and full involvement of healthcare workers (Katusiime, 2018; USAID, 2016; Wafula et al., 2019; WHO, 2017). High resource countries for example USA, Canada and UK comply with a policy guideline developed by the WHO to deal with their medical waste. They also have standard laws in place, as well as stringent and regular implementation of these laws (USAID, 2016; WHO, 2017). On the contrary, Asian developing countries have a dissimilar scene concerning medical waste management; they possess merely basic laws and weaker regulatory bodies to impose the management of medical waste (Cozendey-Silva, Ribeiro-da-Silva, Larentis,

Wasserman, Rozemberg, & Teixeira, 2016; Khan, Cheng, Khan, & Ahmed, 2019). A few countries in the Asian region have devised a wide range of rules and regulations for medical waste management. However, evidence suggests that majority of the Asian countries rarely follow the rules and regulations in medical waste (Khan et al., 2019; WHO, 2017).

Low financed healthcare systems, inadequate training and low knowledge regarding rules and laws on handling medical waste have augmented inappropriate management of medical waste with in health facilities (Anozie, Lawani, Eze, Mamah, Onoh, & Anozie, 2017). A number of countries including Ethiopia, Botswana, Nigeria and Algeria lack national guidelines in order to comply to correct management of medical waste. Burning is the frequently opted method of waste disposal that leads to quick reduction of 90% of medical waste (Chisholm, Zamani, Negm, Said, Abdeldaiem, & Akrami, 2021; Cozendey-Silva et al., 2016; Deress et al., 2019).

In Uganda, compliance with medical waste management guidelines is still low (Mbabazi, 2018). Incorrect practices which include mixing hazardous and non-hazardous waste, over filling of waste containers and unsafe handling and disposal of sharps are predominant among healthcare workers (Akulume & Kiwanuka, 2016; Katusiime, 2018; Wafula et al., 2019). Noncompliance to medical waste management guidelines predisposes healthcare workers to hospital acquired infections (Akulume & Kiwanuka, 2016; Wasswa, Nalwadda, Buregyeya, Gitta, & Nuwaha, 2015; Wen-Tien, 2021).

In summary, adherence of healthcare workers to standard guidelines and protocols on medical waste management can adequately prevent hospital acquired infections. However, healthcare workers are not fully utilizing medical waste management guidelines. This makes waste management a serious problem. In Uganda, compliance to medical waste management guidelines is still low. Incorrect practices include: mixing hazardous and non-hazardous waste,

over filling of waste containers and unsafe handling and disposal of sharps. Non-compliance to medical waste management guidelines predisposes healthcare workers to hospital acquired infections. There is a need to devise measures that will ensure that healthcare workers adhere to the guidelines concerning medical waste management.

### **Healthcare Workers Face Challenges in Management of Medical waste**

Despite the fact that the WHO and MOH have developed standard guidelines, failure of health care workers to comply with proper medical waste management has remained a problem (Akulume & Kiwanuka, 2016; Chisholm et al., 2021; Cozendey-Silva et al., 2016). This could be attributed to inadequate knowledge, attitude, and poor segregation practices of healthcare workers concerning medical waste management.

#### **Knowledge on medical waste management.**

Globally, healthcare staff rarely segregates hazardous medical wastes (USAID, 2016). Usually, hazardous waste is combined with non-hazardous waste. Inadequate knowledge amongst healthcare workers is the main obstacle while dealing with medical waste (Sachan, Patel, & Nischal, 2012; Woromogo, Djeukang, Moussa, Antaon, Kort, & Tebeu, 2020). Studies indicate that medical waste management is mainly influenced by inadequate training, and low awareness on medical waste management (Omoleke, Usman, Kanmodi, & Ashiru, 2021; Sadeghi1, Tol, Baikpour, Moradi, & Hossaini, 2014). In Asia, nonexistence of training programs on medical waste management has resulted into unawareness amongst healthcare workers which leads to improper handling of medical waste and diverse health threats (Khan et al., 2019).

State and private hospitals in African countries such as Algeria, Nigeria, Ethiopia, Botswana, Ghana and South Africa indicate a low level in management of medical waste. A number of healthcare staff are not aware of the guidelines concerning medical waste handling

and disposal method (Awodele, Adewoye, & Oparah, 2016; Chisholm et al., 2021; Deress et al., 2019; Indupalli, Motakpalli, Giri, & Bendigiri, 2015). Pharmacies in Algeria, Botswana, and South Africa are not aware with the how and where the medical waste is disposed of. In addition, lack of financial support hinders contractual services such as segregation, transportation and storage (Akkajit, Romin, & Assawadithalerd, 2020; Mugabi et al., 2018).

In Uganda, three good studies have been conducted and they show that the knowledge of health care workers is strongest in the methods of waste disposal and the color-coding system, the various health problems caused by medical waste and the fact that medical wastes must not be kept for more than 48 hours (Mbabazi, 2018; Musinguzi et al., 2017; Wasswa et al., 2015). The same studies show that healthcare workers have the lowest knowledge on: waste management policy, identification of biohazard symbol, segregation of medical waste based on color codes, safe disposal of blood and blood products, managing human tissue remains, and irregular emptying of waste containers. Healthcare workers reassemble used needle from a syringe which contradicts the guidelines on disposal of used syringes and needles. This leads to an increase in the prevalence of needle stick and sharp injuries, which mainly occurs during the handling of medical waste (Mbabazi, 2018; Musinguzi et al., 2017; Wasswa et al., 2015).

#### **Attitude on medical waste management.**

Thoughts or feelings of healthcare workers are more important than the technology (USAID, 2016). The WHO (2017) states that the management of medical waste by a well-trained, motivated staff with a positive attitude offers further safety for healthcare staff and the society (WHO, 2017). Globally, studies show that nurses in many health facilities have the tendency of an “I do not care” attitude (Akkajit et al., 2020; Cozendey-Silva et al., 2016; Khan et al., 2019). In Asia, healthcare workers lack confidence toward proper management of wastes they generate despite of the good attitude they express towards the proper handling of medical

waste (Khan et al., 2019). Over half of healthcare workers in Thailand have a positive mind-set regarding appropriate disposal and handling of medical waste though unacquainted with the dangers regarding inappropriate disposal (Akkajit et al., 2020). Yet a positive mind-set concerning appropriate medical waste handling in the health facility is a vital discovery by the WHO showing that the individual is very important compared to technology when it comes to appropriate medical waste management (WHO, 2017). Evidence shows that a well-trained and enthusiastic healthcare staff can effectively manage medical waste hence promote safety of the healthcare staff, clients and the public (Anozie et al., 2017).

In India, doctors exhibited a good attitude in respect to the procedure for segregation and final disposal of hazardous medical waste than (Indupalli et al., 2015; Khan et al., 2019; Sharma, Hiremath, Sudeepa, & Kiran, 2017). Conversely, in a different study carried out in India, nurses had enhanced attitude concerning waste segregation, appropriate disposal, execution of guidelines and collaboration in programs than the laboratory technicians (Al-Seraty, & Wafaa, 2014). Furthermore, findings from a study carried out in Bangalore showed that nurses had more positive attitudes than laboratory technicians (Hosny, Samir, & El-Sharkawy, 2018). In the same study, general practitioners believed that managing medical waste was extremely costly but could not be compromised since the waste was infectious and inappropriate management could result into spread of hospital acquired infections (Hosny et al., 2018). In addition, nurses believed that appropriate management of waste was an added load at work (Indupalli et al., 2015; Sharma et al., 2017). Few nurses and physicians agreed that appropriate management of medical waste must be a main concern, waste management needs joint effort and that waste management is a fiscal load on the health facility (Indupalli et al., 2015; Khan et al., 2019; Sharma et al., 2017). Healthcare workers in Botswana thought that appropriate management of medical waste

was their responsibility and not added load (Mugabi et al., 2019). As well, healthcare workers agreed that medical waste management should be carefully monitored by management (Sharma et al., 2017).

A study carried out in four African countries including Ethiopia, Botswana, Nigeria and Algeria shows that the attitude of healthcare workers regarding separation of hazardous and non-hazardous waste, appropriate disposal and execution of guidelines is encouraging (Chisholm et al., 2021). In Botswana, nurses have the enthusiasm to segregate medical waste, appropriately dispose, implement the guidelines and collaborate in programs (Chisholm et al., 2021). Furthermore, physicians believe that appropriate management of medical waste is vital in prevention of disease transmission; wearing protective gears lessens the danger of contracting the disease. Also, nurses show readiness to collaborate with the health facility waste management committee (Chisholm et al., 2021).

Studies conducted in Nigeria and Ethiopia show that healthcare workers take full responsibility on medical waste management in their units which shows good attitude. However, there are barriers which hinder them from managing medical waste (Chercoset al., 2018; Deress et al., 2019; Ellenkilet al., 2021; Mugabi et al., 2018; Okechukwu, Aguora, & Oparah, 2019; Olaifaac, Govenderbc, & Ross, 2018). The most commonly reported is lack of knowledge and training. This is mainly because majority of nurses do not take waste segregation as an area to worry (Okechukwu et al., 2019). Other barriers include: lack of knowledge regarding health risks, deficient fiscal and human resources for appropriate management and reduced control of medical waste management (Mugabi et al., 2018; Olaifaac et al., 2018). Interventions to improve inappropriate management of medical waste include: provision of sufficient numbers of waste bins, training and supervision of health care workers on a regular basis (Deress et al., 2019;

Ellenkil et al., 2021). Healthcare workers in Cameroon agreed with the statements: waste produced in health facility should be handled properly, protective shields must always be put on to avoid risks associated with contact, and separation of waste at the point of production is imperative (Chercos et al., 2018; Deress et al., 2019; Woromogo, 2020). Okechukwu et al. (2019) observed that health care workers in Nigeria comply with the fundamental safety measures associated with waste separation, and agree that it is essential to put on protective shields to lessen exposure to the extremely infectious waste and to curb the spread of hospital acquired infections. Knowing self is one of the significant skills that affect excellence in management of medical waste (Ellenkil et al., 2021).

Although health care workers in Uganda express a positive attitude concerning appropriate medical waste management, they are uninformed of the risks related to inappropriate waste management (Akulume & Kiwanuka, 2016; Katusiime, 2018; Wafula et al., 2019; Wasswa, et al., 2015). There is need to train healthcare workers on the hazards of improper medical waste management. Studies conducted in Uganda show that nurses have a positive attitude towards segregation of medical waste, appropriate dumping, execution of the regulations and collaboration in programs (Wafula et al., 2019; Wasswa, et al., 2015). Akulume & Kiwanuka (2016) noted that doctors' attitude towards medical waste management is casual, while nurses and paramedical staff are more meticulous and careful. There is need for proper trainings, and motivation of healthcare workers to improve the development of a positive attitude on medical waste management (Akulume & Kiwanuka, 2016).

### **Practice of medical waste management.**

Medical waste management is a sensitive subject across the globe (USAID, 2016). Separation of medical waste is a critical step of waste handling (WHO, 2017). The nonattendance to waste segregation leads to increased amount of hazardous waste that harness the likelihood of turning domestic waste into infectious waste (Deress et al., 2019). In high resource countries, the regulations and implementation of waste separation are carefully and largely practiced (USAID, 2016). In Asian countries, studies indicate a deficiency in appropriate practice during separation, collection, storage, transportation, disposal and implementation of standards (Akkajit et al., 2020; Cozendey-Silva et al., 2016; Hosny et al., 2018; Khan et al., 2019). Healthcare facilities in Asia do not have infectious waste labeling, appropriate color-coded containers, and storage facilities. As well, waste bins are not dumped on time, this results in waste scattering at the site of the container (Cozendey-Silva et al, 2016; Khan et al., 2019). Majority of health facilities do not have storage places and have their waste dumped outside in a public waste heap (Akkajit et al., 2020).

China, India, Pakistan, and Bangladesh are countries found to have insufficiencies mainly with in medical waste produced by health facilities (Al-Seraty et al., 2014; Chisholm et al., 2021; Cozendey-Silva et al., 2019; Deress et al., 2019; Ellenkil et al., 2021; Hosny et al., 2018; Indupalli et al., 2015; Sachan et al., 2012; Sharma et al., 2017). Waste segregation in India is reported to be inadequate, medical waste is combined with domestic waste at the point of collection by waste staff which makes the whole system of medical waste management unsuccessful (Sharma et al., 2017). In Korea, medical waste was frequently combined with community solid waste and dumped in residential waste landfills (USAID, 2016).

In Nigeria, Cameroon and Ethiopia, waste is collected alongside other waste stream. Medical waste is combined with community waste in the collecting containers and dumped in a similar way (Chercos et al., 2018; Deress et al., 2019; Mugabi et al., 2018; Olaifaac et al. 2018; Okechukwu et al., 2019). Hospitals assessed in Lagos combined domestic waste and medical waste in the onsite storage facility (Okechukwu, Oparah, & Aguora, 2017; Okechukwu et al., 2019; Omoleke et al., 2021). The difficulties these facilities encounter include: inappropriate storage, and regular disposal of hazardous waste with domestic waste. (Okechukwu et al., 2019; Omoleke et al., 2021).

In Uganda, medical waste segregation is not proper, domestic and sharp wastes are often assorted in common waste collection containers (Akulume & Kiwanuka, 2016; Katusiime, 2018; Wafula et al., 2019; Wasswa, et al., 2015). Further still, some healthcare workers do segregate medical waste except sharps which are found assorted with general waste during burning (Katusiime, 2018). This shows that separation of medical waste is not rightly done regardless of the accessibility of color-coded containers. Nurses adequately practice proper medical waste management compared with the technicians (Wafula et al., 2019). Further still, Katusiime (2018) determined that doctors and nurses have better practices in management of medical waste when compared to the physiotherapists, occupational therapists, and clinical psychologists. There is need for the health facility medical waste management committees to take note of the factors that enhance performance and put in place measures to sustain such factors (MOH, 2013).

In one study, healthcare workers in public health facilities were found to segregate medical waste better than those who work in private health facilities (Akulume & Kiwanuka, 2016). In the same study, although separation was done at the point of production, sharps were found combined with non-hazardous waste at the time of burning. This shows that separation of

medical waste is not appropriately done, regardless of the accessibility of the color-coded containers. Similarly, Mbabazi (2018) observed that waste segregation is not proper since domestic waste and sharps are regularly assorted in the ordinary collection containers.

Appropriate waste separation should follow standard measures; according to national guidelines (MOH, 2018). Most of the healthcare facilities in Uganda do not have areas to dump medical waste and they use rubbish pits or latrines for used syringes and needles. The garbage pits are very superficial, discarded syringes can be easily regained from them (Wafula et al., 2019; Wasswa, et al., 2015). These practices are not adequate for medical waste management (WHO, 2018). The major challenge healthcare workers face is lack of equipment for medical waste management for example color coded waste bins and liners, safety boxes and gloves to handle medical waste (Wafula et al., 2019). The health facility medical waste management committees need to take note of the factors that enhance performance and put in place measures to sustain such factors.

In summary, healthcare workers do not follow the recommended guidelines for medical waste management, do not separate medical waste at the point of production, and mix sharp waste with solid waste. This shows that the awareness, mind-set and practice of medical waste management is inadequate. This could increase the risk of hospital acquired infections among health care workers. There is need for health facility administrators to educate healthcare workers on the importance of proper medical waste management, increase the self-efficacy of health care workers as a way of motivation and to provide the necessary equipment for medical waste management.

## **Multiple Strategies Improve Management of Medical Waste**

Studies show that continuing health education of healthcare workers at health facility level helps to support staff members use secure methods of medical waste management (Hosny et al., 2018; Sahiledengle, 2019; Shabibi, Zavareh, Sayehmiri, Qorbani, Safari, & Mansourian, 2017; Sharma et al., 2017; Zagade, & Pratinidhi, 2014). Educating healthcare workers about waste management can promote waste handling, better wellbeing and save money (Shabib et al., 2017; Zagade & Pratinidhi, 2014). Health facilities that implement diverse teaching experiences enhance waste management by means of diverse educational strategies for example presentations, seminars, informative emails, posters, and flipcharts (Sahiledengle, 2019; Sharma et al., 2017). An education intervention program implemented in south east Ethiopia showed that three months after implementation healthcare staff demonstrated good awareness, mind-set and practice level towards medical waste management (Sahiledengle, 2019). In Sudan, an intervention program that included lectures, group discussions, videos, demonstrations, health talks, and power point presentations resulted in improvement in nursing staff knowledge, and practice about management of medical waste three months after the intervention program (Shabib et al., 2017).

In their study, Hosny et al. (2018) determined that lectures and discussion methods, power point presentations and videos as teaching aids used in the education intervention of health care workers increased knowledge in all but for areas the need to separate medical waste, awareness of color codes for separation of various kinds of medical waste, dumping of general waste in black bins and dumping of hazardous waste in red bins. In addition, Scholz, Ngoli, & Flessa (2015) shows that formation of a prior healthcare waste management committee before training healthcare workers on medical waste management increases knowledge and practices on medical waste management. In Pakistan, a rigorous medical

waste management instruction model amongst healthcare workers showed a rise in awareness, attitude and practice three months following intervention (Kumar, Somrongthong, & Ahmed, 2016). Similarly, Zagade & Pratinidhi (2014) found out that a rigorous medical waste management education model is an efficient strategy for enhancing knowledge, attitude and practices among healthcare workers. Regular trainings reduce hazards attached with infectious wastes. Face to face trainings aiming at continuous education of professionals enhance waste management practices of the staff in health facility environment (Hosny et al., 2018; Sahiledengle, 2019). Face to face trainings that are periodic and intensive provide new learning and reinforce key messages on management of hazardous waste; this minimizes the hospital acquired infections. Reminder services by health facility management distributed during weekly staff meeting on regular basis for the twelve weeks empowered staff to advance their attitude modify behavior and helped to sustain good health waste management practices (Scholz et al., 2015). Practical demonstration in the intervention health facility brought constructive results in improving appropriate practice of waste management (Shabibi et al., 2017). Personal teachings with demonstration are the most efficient approach to teach and envision the appropriate skill in management of medical waste. Demonstration makes health care workers more proficient in practicing appropriate coding at their work place (Sharma et al., 2017).

WHO developed an individualized rapid assessment tool to help promote best medical waste management practices at health facility level (WHO, 2017). Proper medical waste management helps to lessen the magnitude of infection associated with inappropriate medical waste management. Scholz, et al. (2015) used rapid assessment tool in three hospitals, A, B, and C, to measure the state of the healthcare waste management system. Implementation was on going for two years and results showed that hospital A and B scored highly and hospital C had a

moderate score regarding to effectiveness. Further still, the training of health professionals including doctors, nurses and waste handlers on health care waste management using rapid assessment tool demonstrated that the low results of the pre-test were improved to excellence in the post test (Hosny et al., 2018). There is need for robust implementation of utilization of individualized rapid assessment tool to improve knowledge, attitude and practice of healthcare workers. Moreover, Scholz et al. (2015) in their study rapid assessment of infrastructure of primary health care facilities reported that the tool easily detected serious infrastructural deficiencies in medical waste management. This means that the individualized rapid assessment tool reminds nurse leaders to ensure that all the necessary material for waste management is in place. Scholz et al. (2015) recommend integrating the utilization of individualized rapid assessment tool in management of medical waste especially in low resource countries. This may significantly reduce the risk and occurrence of hospital acquired infections among health care workers. Also, may easily promote a health working environment for healthcare workers.

In summary, various strategies have been used to improve the knowledge, attitude and practice of medical waste management. Such strategies include: education talks, continuous medical education, seminars, and lectures; group discussions, videos, demonstrations, informative electronic mails, posters, and power point presentations in addition to intensive healthcare waste management model. These strategies have helped to minimize hospital acquired infections. However, the individualized rapid assessment tool is another strategy developed by the WHO and seems to promote best practices and standards of individual health facilities. The tool has been utilized elsewhere and found to be highly effective in improving knowledge, attitude and practice of healthcare workers concerning management of medical waste. The tool also helps nurse leaders to ensure that all the necessary material for waste management is in

place. In Uganda, the individualized rapid assessment tool has not been tried to better the knowledge, attitude and practice of healthcare workers regarding management of medical waste. This study is to determine the effect of an education intervention based on utilization of an individualized rapid assessment tool on the knowledge, attitude and practice of healthcare workers regarding medical waste management at Health Center III's in Uganda.

### **Health Belief Model is applicable to Medical Waste Management**

#### **Perceived barriers.**

While attempting to manage medical waste, healthcare workers may face some challenges that may act as obstacles thus interfering with the process even if someone was willing and knew what to do. A study by Katusiime (2018) perceived the following barriers to medical waste management: lack of knowledge and training prior to placement, complacency, the belief that one person cannot make a difference, and competing demands. Other perceived barriers include: conflicting advice, attitude of mentor and influence of mentor's practices. In relation to filling sharp containers more than  $\frac{3}{4}$ , busy schedules are commonly mentioned as a factor inhibiting good practice. Sharp segregation practices are also highlighted as an area of improper practice due to lack of preparations of equipment or forgetfulness. Mbabazi (2018) reports non-availability of medical waste equipment as another barrier to medical waste management. Perceived barriers can remain a great challenge to medical waste management as they may negatively influence the appropriate practice. To improve medical waste management practice, it is essential to minimize the barriers for example by having medical waste management guidelines in place, conducting trainings on medical waste management (Katusiime, 2018) and use of effective tools like individualized rapid assessment tool.

### **Modifying variables to medical waste management.**

Modifying factors are key to medical waste management as they tend to improve practice. Modifying factors to improve practice of medical waste management include: role modeling of appropriate practice by senior staff, having sound knowledge base prior to the practice of managing medical waste (Khalid et al., 2021; Mugabi, 2018; Olaifaac et al., 2018; Okechukwu et al., 2017; Okechukwu et al., 2019; Sahiledengle, 2019). On the contrary, having sound knowledge base prior to practice or theoretical knowledge on medical waste management is identified by some healthcare workers as a motivator (Mugabi, 2018). Having clear understanding of the rationale for protocols persuades healthcare workers to comply more as compared to having knowledge of the protocols and guidelines without clear research evidence (Olaifaac et al., 2018).

Also, a study conducted by Okechukwu et al. (2019) in Nigeria identified other modifying variables like education level of healthcare worker, past experiences, adequate knowledge, and motivation of healthcare worker for example through attending regular continuous professional developments on medical waste management, and recognition of positive performance by supervisor. In Ethiopia, female nurses have higher knowledge of medical waste management than male nurses (Deress, et al., 2019). Likewise, the different nursing cadres also differ accordingly with enrolled nurses exhibiting appropriate practice than diploma and degree nurses. Healthcare workers who are 30 years and above are less compliant with medical waste management than those between 24 and 29 years (Deress, et al., 2019). The medical waste management committee in collaboration with health facility management need to take note of factors that enhances the appropriate practice and put in place measures to sustain such factors (Chercos et al., 2018).

**Cues to action.**

Reminders can act as cues to action in addition to monitoring practice (Sahiledengle, 2019). If there are regular checks on standards, healthcare workers would maintain the appropriate practice at all times. Mugabi et al (2018) in their study also identified that distributing leaflets amongst healthcare workers, scattering posters in various places on wards about the benefits of complying with medical waste management protocols and guidelines are considered to be a useful way to keep healthcare workers in line with protective guidelines. Cues to action are important if healthcare workers are to manage medical waste. They tend to improve compliance to the proper practice (Mugabi et al., 2018). It is therefore important that healthcare workers are reminded, and monitored in order to improve medical waste management practice (Sahiledengle, 2019). Reminders can be in form of leaflets or posters focusing on medical waste management (Hosny et al., 2018). The utilization of an individualized rapid assessment tool is another effective cue to action that could help to overcome challenges that healthcare workers face in managing medical waste (Scholz et al., 2015). This study will therefore determine the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers regarding management of medical waste at selected health center III's in Mukono District.

**Gap this Study Addresses**

The major gap this study addresses is that healthcare workers face challenges in practicing proper management of medical waste which could be attributed to inadequate knowledge, attitude and poor segregation practice of healthcare workers concerning medical waste management. Healthcare workers are not always practicing proper management of medical waste putting them at risk.

Healthcare workers face barriers that interfere with proper practice of medical waste management. The barriers include: lack of knowledge, belief that one person cannot make a difference and compelling demands. Modifying factors to improve the practice of medical waste management comprise of role modeling of appropriate practice by a senior staff, and having a sound knowledge base prior to the practice of managing medical waste. Cues to action like reminders, monitoring practice, scattering posters and use of individualized rapid assessment tool help to overcome barriers that healthcare workers face in managing medical waste.

### **Summary**

Chapter Two reviewed literature on a variety of important topics. The first topic was medical waste is a global concern for healthcare workers. Then the literature on standard guidelines on medical waste management drive practice was considered. Literature showed that healthcare workers face challenges in management of medical waste. Multiple strategies improve management of medical waste. Finally, the chapter reviewed literature that the health belief is applicable to management of medical waste. Studies indicate that education of healthcare workers improves the knowledge, attitude and practice level towards medical waste management. The individualized rapid assessment tool was developed by the WHO to promote safety practices and develop safety standards regarding management of healthcare waste. The tool has been found to be effective when used to train health care workers leading to excellent outcomes regarding knowledge, attitude and practice. This study therefore determined the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers regarding management of medical waste at selected Health Center III's in Mukono District. This chapter was followed by Chapter Three which described the research methodology. Chapter Three included: the study

method, design, setting, population, sampling procedure, inclusion criteria, data collection tool, data collection techniques, data analysis, rights of subject and ethical implication.

### **Chapter Three: Methodology**

This chapter provides an account of the research method that will be used during the study. This includes: the study method and design, study setting, study population, sampling procedure, and inclusion criteria. In addition, the chapter looks at the data collection tool/instrument, data collection/measurement techniques, data analysis, rights of subject and concludes with ethical implication.

#### **Study Design**

A quasi-experimental design was used. This is because it is suitable for measuring change (Polit & Beck, 2008). The intervention involved utilization of an individualized rapid assessment tool, teaching healthcare workers the importance of medical waste management and review of protocols and guidelines on medical waste management. Knowledge, attitude and practices of healthcare workers was tested before and after the educational intervention to enable the researcher to determine the change in practice of medical waste management. This allowed the researcher to clearly interpret the effect. A quantitative research methodology was used to help the researcher find answers to the research question.

#### **Study Setting**

The study was carried out at a district in Central Region of Uganda. The district was an appropriate setting to sample because its' health center III's have similar characteristics to other health center III's in Uganda. That is, they are found in every sub-county, serve a population of about 20,000 people, have the same staffing level of about 18 staff, are headed by a senior clinical officer, and offer similar services aiming at disease prevention, health promotion, provide outpatient and inpatient services, maternal child health and laboratory diagnostic

services. The critical sites where waste is managed include: the outpatient, dressing room, treatment room, laboratory and maternity.

### **Study Population**

The study population included health care workers working at health center III's in Uganda. They included: nurses, midwives, clinical officers and laboratory technicians.

### **Sample**

The sample included health care workers who are: clinical officer, nurse, midwife, or laboratory technician. These were in government health center IIIs.

### **Sampling Technique**

The study district has 12 health center III's. The researcher made a sampling frame to provide a list of all health center III's from which health centers to participate in the study were chosen. Used simple random sampling to get 50 percent which is six health center III's. Since this was an interventional study, the researcher piloted the intervention in two which were randomly sampled from six health center III's. Health centers were assigned a number consecutively. A table of random numbers was used to draw a sample of two health center III's to participate in the study. Simple random sampling was used because it prevents researcher biases, ensures that the differences in the sample and the population are purely a function of chance (Polit & Beck, 2008). Participants were selected by use of consecutive sampling approach. Consecutive sampling is a technique in which every subject meeting the criteria of inclusion is selected (Polit & Beck, 2008). Because my sample size was small, consecutive sampling technique provided an equal opportunity for every healthcare worker to be involved in the study (Polit & Beck, 2008)

## Sample Size

Sample size was determined by Krejcie and Morgan's formula for sample size determination.

$$S = \frac{x^2 N p (1 - p)}{d^2 (N - 1) + x^2 p (1 - p)}$$

Where,

$S$  = Required sample size

$x^2$  = The table value of chi-square for 1 degree of freedom and confidence 95% = 3.841

$N$  = The population size

$P$  = The population proportion (assumed to be .50 since this would provide the maximum sample size)

$d$  = Degree of accuracy expressed as a proportion (.05) (Krejcie & Morgan, 1970).

$$S = \frac{3.841 \times 3.841 \times 36 \times 0.5(1 - 0.5)}{0.05 \times 0.05(36 - 1) + 3.841 \times 3.841 \times 0.5(1 - 0.5)}$$

From the formula, the sample size ( $S$ ) was 35. Krejcie and Morgan's formula helped the researcher to effectively determine the number participants needed to represent a population (provided representative statistical sample). The maximum sample size consisted of 36 health care workers which is 18 from each health center. The sample provided a representative sample for the quantitative study. These health care workers had characteristics that approximate those of the population. The researcher did not use any control measure.

### **Inclusion criteria**

This included health care workers who are: clinical officers, nurses, midwives, and laboratory technicians. This is because they deal with the medical waste at the point of generation, storage and final disposal and were able to carry out a self-assessment using the medical waste rapid assessment tool. In addition, healthcare workers had clinical experience of two years and were employed in one of the targeted health center III's.

### **Data Collection Tools**

Data was collected using two different tools and these were: a self-administered structured questionnaire (Appendix B) and an observation checklist (Appendix C). The questionnaire was developed by the researcher guided by the MOH national medical waste management guidelines (MOH, 2013). In addition, the attitude section was adapted with permission from a questionnaire used by Sebuliba (Appendix D) in her dissertation for the masters of nursing science degree. The questionnaire was made up of three sections: section A) contained questions (1-7) on socio demographic characteristics of the health care workers including age, gender, profession, qualification, work experience and previous training on waste management. Section B) consisted of 25 knowledge questions (8-32), 17 items were constructed in a way that a respondent was given a list of kinds of wastes generated in health facility and they selected the recommended color-coded bin. Eight items were multiple choice. These questions contributed to answering objective one which was about effect of an education intervention based on utilization of individualized rapid assessment tool on knowledge of healthcare workers.

Section C) contained 21 questions (33-53) and solicited data related to the attitude of health care workers regarding medical waste management. It contributed to answering objective two which was about effect of an education intervention based on utilization of individualized rapid assessment tool on attitude of healthcare workers. Attitude questions were developed based on the Health Belief model but using statements from waste management guidelines. The attitude questions were on a four-point Likert scale with response continuum of “strongly disagree”, “disagree”, “agree” and “strongly agree”.

The observation checklist (Appendix C) was developed using MOH medical waste management guidelines. The checklist was used to observe the actual practice of healthcare workers concerning management of medical waste basically segregation, disposal into color coded bins, replacement when container was  $\frac{3}{4}$  full, and availability of bins, posters, and gloves. The observation checklist contributed to answering objective three which sought to describe the effect of an education intervention based on utilization of an individualized rapid assessment tool on the practice of health workers regarding medical waste management at Health Center III's in Uganda. The observation checklist was for each unit, that is, outpatient treatment room, dressing room, laboratory and maternity. The observation checklist was also used to capture the availability of medical waste supplies.

### **Scoring the Knowledge, Attitude and Practice Questions**

#### **Knowledge.**

The incorrect responses were scored “0” and the correct responses scored “1”. Total number of responses were 25. Generally, knowledge score was calculated by summing up all the study participants' total knowledge scores. Descriptively, the pre-intervention and post-intervention knowledge level was classified as excellent, moderate or low. In this study, excellent knowledge was put on a cut-off point of 80 percent. Other studies that have looked

at knowledge of healthcare workers on waste management have used  $\geq 80\%$  to be excellent, 50-79% moderate and  $< 50\%$  low (Akkajit et al., 2020; Deress et al., 2019; Elnour, Moussa, El-Borgy, Fadelella, & Mahmoud, 2015; Olaifaac et al., 2018). So, excellent knowledge  $> 80\%$  of total score (or score 20-25) or moderate knowledge 50-79% of total score (or score 13-19) and low knowledge  $< 50\%$  (or score 13 and below).

### **Attitude.**

Attitude was scored on a four-point Likert scale of measurement; “strongly disagree”, “disagree”, “agree” and “strongly agree”, which were scored as 1, 2, 3, and 4 respectively. Scores for negatively phrased statements were reversely coded during the period of data entry as 4, 3, 2, and 1. Strongly disagree and disagree was combined to reflect a positive attitude; then strongly agree and agree reflected a negative attitude. Other studies that have looked at attitude of healthcare workers on medical waste management have used mean  $> 3.50$  to be positive and mean  $< 3.50$  to be negative (Kumar et al., 2016; Sofia, Wiku, Hafni, & Ratna, 2021; Tabash, Rim, Aleya, El-Borgy, & Bassam, 2019). In this study, mean  $> 3.47$  was positive attitude; mean  $< 3.47$  was negative attitude.

### **Practice.**

The researcher filled in the checklist directly using the responses “not done, partially done and done”. “Not done” and “partially done” were assigned 0 and “done” was assigned “1”. The highest score was 13(100%). In this study, practice was classified into: excellent, moderate and poor. Other studies that have looked at practice of healthcare workers on waste management have used  $> 75\%$  to be excellent, 50-74% moderate and  $< 50\%$  poor practice (Akkajit et al., 2020; Deress et al., 2019; Elnour et al., 2015; Olaifaac et al., 2018). A score of 10-13 (100%) was excellent practice, 7-10(50-74%) moderate and below 7 ( $< 50\%$ ) was poor practice.

**Validity**

Refers to the extent to which a tool measures what it is planned to measure (Polit & Beck, 2008). Content validity was considered in this study. The questionnaire was evaluated by faculty of Uganda Christian University and my classmates because they are in supervisory and leadership positions hence considered as content validity experts. Their corrective comments on the relevance, clarity and comprehensiveness of the items in the questionnaire were applied. To ensure internal validity, the questionnaires were self-administered in English the official language of training healthcare workers. To ensure external validity the researcher developed the questionnaire and observation checklist basing on constructs of HBM and MOH medical waste management guidelines (MOH, 2018).

**Reliability**

To ensure reliability, the questionnaire and observation checklist was pre-tested in a similar setting (another district in the Central Region). Four healthcare workers (10% of sample size) in two public health center III's were used to pre-test the tool. The district where the pre-testing of the tools was done was selected because of the similar characteristics its health center III have in relation to the district where the study was conducted. This data was not incorporated into the study results. The pre-test was performed in order to establish the clarity, comprehensibility, relevance, errors and to note length of time taken to complete the questionnaire. The researcher also calculated Cronbach's alpha to determine the reliability of the questionnaire. Cronbach's alpha for all items was 0.967. This is close to 1 and the tool was considered reliable.

## **Data Collection Process**

Data was collected from two different health center IIIs for a period of six weeks in each health center III. The data collection process included: pre-intervention, intervention and post-intervention phases.

### **Pre-intervention phase.**

This phase had three distinct parts which included: permission to enter site, observation of practice, and data collection using a questionnaire. These are explained below.

#### ***Permission to enter site.***

The researcher took a letter from Uganda Christian University (UCU) to introduce me to the office of District Health Officer (DHO). The DHO gave the researcher permission to enter the different study sites. The researcher gave the letter from DHO to the head of the health facility who allowed me to access the study participants through the different heads of units. The head of the health facility introduced the researcher to the in-charges of the units where she planned to collect data by asking them to allow her in their units.

#### ***Observation of practice.***

Once the in-charges allowed the researcher in their units, it acted as consent to observe the practice of medical waste management. At this point, the researcher informed the in-charges that she was going to their units to get acquainted to what was going on. As the researcher entered each unit, the in-charge introduced her to other people he/she works with. The researcher used the observation Checklist (Appendix C) to record the practice of medical waste management in each selected unit. The researcher made observations in the outpatient, treatment room, dressing room, laboratory, and maternity to ensure availability of color-coded bins, posters and gloves. In addition, the researcher observed the segregation, disposal of medical waste in the

color-coded bins, and replacement of container when  $\frac{3}{4}$  full. After observing the practice, the researcher found out which of the days of the week was appropriate to meet the rest of the healthcare workers so that the head of the facility and the in-charges of the units help her to mobilize them on the agreed day.

***Data collection using a questionnaire.***

On the agreed day, the researcher met the entire group of healthcare workers. She introduced myself, the study, and collected data using the questionnaire and introduced the intervention. The researcher invited participants to the study that took six weeks in each health center III. Every healthcare worker who met the inclusion criteria was invited to participate in the study. The researcher gave out an informed consent form (Appendix E) to all participants who showed interest in the study to sign. The filled consent form was then put in an envelope and sealed. The researcher administered the pre-intervention questionnaire to collect the first set of data from healthcare workers. This took 30 minutes. The participants were asked not to write their names on the questionnaire, they were given small pieces of paper containing unique identifiers (codes) countersigned by the researcher. Every participant was requested to write the code they have received on the space provided for on the questionnaire before handing it in to the researcher. Participants were asked to ensure completeness of the questionnaire. Participants were requested to write their names on the envelopes containing the codes they had written on the questionnaire. Participants then sealed the envelopes and returned them to the researcher for safe keeping until the post-intervention time. All the completely filled questionnaires were collected and kept by the researcher under lock and key and were not accessed by any other person.

**Intervention phase.**

The intervention phase involved: a teaching session using a handout (Appendix G), PowerPoint (Appendix H), and a brochure (Appendix I). The researcher described and demonstrated to the healthcare workers on how to use the Individualized Rapid Assessment Tool. Follow up on medical waste management and use of the Individualized Rapid Assessment Tool was done for four weeks at each study site.

***Teaching session (Appendix G).***

After collecting the pre-intervention questionnaire, a teaching session followed. This took 60 minutes. The researcher used a power point presentation. It was an interactive session and included: review of the kinds of medical wastes plus the risks caused by inappropriate medical waste management. Principles and guidelines for management of each type of medical waste were described. Each participant was given a handout of the teaching session. The handout helped the healthcare workers to follow what was said during the presentation, and got a broad outline of ideas. Healthcare workers focused on listening rather than taking notes. The handout was reviewed by the healthcare workers after the teaching session. In addition, a brochure with key messages was handed out. The brochure contained messages about the kind of medical waste and the type of recommended color-coded waste bin, handling, transport and benefits of appropriate medical waste management. The brochure was provided to healthcare workers so they could refer to the information and also share with other healthcare workers who did not participate in the study.

***Introduction of individualized rapid assessment tool [IRAT], (Appendix A).***

All healthcare workers were trained on how to utilize the IRAT but only those who met the inclusion criteria participated in the study. The researcher introduced the IRAT. Each participant was given a copy of IRAT to allow them follow as the researcher explained and demonstrated how to use it. The researcher explained the two parts of the IRAT. In part one, I explained the six areas of the IRAT which included: organization, policy and planning, training, occupational health and safety, monitoring, evaluation and corrective action, and financing. In part two, I described how a facility tour is performed and the questions required accomplishing this part. In addition, I demonstrated how healthcare workers could correctly use the IRAT to carry out individual assessment of health facility. Participants were asked to form groups of three, one participant to volunteer and perform a return demonstration as the researcher moved around the room providing the required support and answering questions arising. This session took 60 minutes.

***Individual follow-up of healthcare workers by the researcher.***

After reviewing the importance of protocols and guidelines, teaching the content on waste segregation, storage, disposal and introducing the IRAT, the researcher allowed time for the healthcare workers to practice. After the second week, the researcher followed up the healthcare workers to observe the practice of medical waste management. During the practice, the researcher observed and used the Checklist as a teaching guide. I looked at the checklist and observed what was being done to ensure that the practice was explicit. If there were steps omitted, I showed the learner to guide them on how to perform the step that was omitted. Based on the observation, the researcher helped healthcare workers to improve the practice of medical waste management where the gaps were identified.

The researcher again met one on one with each participant at each critical site (outpatient treatment room, dressing room, laboratory and maternity) on alternating days to offer explanation or verification on what was being done. The researcher asked questions (Appendix J) about challenges in managing medical waste and utilization of the Individualized Rapid Assessment Tool. The healthcare workers were encouraged to utilize the Individualized Rapid Assessment Tool in order to improve practice of medical waste management. The follow up for the individualized rapid assessment tool took four weeks in each health facility. In the last week of the intervention, participants were reminded of the post-intervention data collection.

### **Post-intervention phase.**

After the four weeks of utilizing the Individualized Rapid Assessment Tool, the researcher took two days in each health center III to collect post-intervention data. On day one, the researcher used the checklist to observe the practice of medical waste management. I used the checklist to record the post intervention data, and note whether the steps were fully done, partially or not done. The researcher made observations of the outpatient, treatment room, dressing room, laboratory, and maternity to ensure availability of color-coded bins, posters and gloves. In addition, the researcher observed the segregation, disposal of medical waste in the color-coded bins, and replacement of container when  $\frac{3}{4}$  full.

On day two, the researcher organized participants together as in the pre-intervention phase. I asked each participant to complete the questionnaire post-intervention in the same room that was used for pre-intervention. The researcher returned the envelop bearing the participant unique identifier. Participants were asked to get their envelope, open it and use the code in the envelope. This ensured that the pre-intervention and post-intervention codes were matching. The participants were asked to ensure completeness of the tool. Completed post-intervention

questionnaire were returned to the researcher, for storage under lock and key. The participant codes were destroyed afterwards. This prevented the researcher from linking the participants with their questionnaire.

### **Data Control**

Privacy was ensured by assigning participants unique identifiers (codes) during the pre-intervention phase. The codes were destroyed after filling the post-intervention tool. In addition, the researcher asked participants to ensure completeness of the tool pre-and post- intervention. The completed tool was kept by the researcher under lock and key. Only the researcher had access to data during data collection. The researcher, supervisor and statisticians had access to data during data analysis.

### **Date Analysis**

The researcher used the Statistical Package for the Social Sciences (SPSS) version 20, software for data analysis. A code book was created for each variable. Coding was done where information was transformed into numbers. Coded data was entered onto different computer files to act as a backup. Data was inspected to compare the pre and post intervention questionnaires. Descriptive statistical analysis was performed in order to compare the average score of knowledge, attitude, practice and IRAT pre and post intervention in each group.

SPSS was run to perform a dependent sample t-test to compare the difference in the means of knowledge, attitude and practice of healthcare workers and use of IRAT before and after intervention. The result of the dependent sample t-test helped the researcher to establish the effect of the education intervention based on utilization of IRAT on knowledge, attitude and practice of healthcare workers. P- Value < 0.05 was considered significant.

## **Ethical Consideration**

Administrative clearance was obtained from Mukono District Health Office (DHO) to act as a preliminary approval that they were willing to allow me carryout the study in the selected health facilities. Then the researcher gained ethical approval from Uganda Christian University (UCU) Research and Ethics Committee. The letter from UCU introduced the researcher to the office of DHO. Researcher gained approval from the Research and Ethics Committee of Mukono District. The DHO gave the researcher a letter that permitted entrance into the different health facilities. The letter from the DHO was given to the heads of the different health facilities to allow the researcher to access the study participants through the different heads of units where data was collected from.

The researcher explained the study aim and methods to the intended participants. Administered a consent form to the participants, which was used to request their permission to take part in the study. Those who consented participated in the study. Participants were informed of the right to withdraw at any time during the study in case there was a change in his/her mind without any penalty. Participation was purely voluntary. The participant was also informed that he/she would not be able to withdraw from the study once they returned the post-intervention questionnaire to the researcher, as after that it was impossible for the researcher to identify their questionnaires.

## **Summary**

Chapter three described the methodology and design that was employed in the study. It also included the population, sample plus study setting. Also, described the data collection, and the data collection instrument. Lastly, the chapter explained how data was analyzed, and the rights of subjects and ethical implications. This chapter was followed by chapter four. Chapter four presented the study findings including demographic data, effect of education intervention

based on utilization of individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers regarding management of medical waste at selected health center IIIs in Mukono district.

## **Chapter Four: Results**

This chapter presents the findings from the study done with 36 healthcare workers on the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of health healthcare workers regarding medical waste management. The analysis presents the demographic data, effect of an education intervention based on utilization of individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers, regarding medical waste management at selected Health Center III's in Mukono District. The results are presented in table and narrative form.

### **Participants' Socio Demographic Data**

The first part of the data presentation is on socio demographics of the healthcare workers. This includes the aspects of age, gender, profession, qualification, work experience, previous training and recent training on waste management. Results are presented in Table 1.

The healthcare workers age ranged from 21-60 years with the majority (55.6%) aged between 21-30 years. Thirty (83.3%) of healthcare workers were females. Nineteen (52.8%) had a diploma in the field of qualification. Twenty-eight (77.8%) had 2-10 years of working experience. The majority (72.2%) had previous training in form of continuous professional development, and 58.3% had the most recent training about waste management in 1-6 months ago.

Table 1

*Socio-Demographic Characteristics of Healthcare Workers*

<b>Variable</b>	<b>Frequency (F)</b>	<b>Percentage (%)</b>
<b>Age in years</b>		
21-30 years	20	55.6
31-40 years	11	30.6
41-50 years	3	8.3
51-60 years	2	5.6
<b>Gender</b>		
Male	6	16.7
Female	30	83.3
<b>Profession</b>		
Nurse	20	55.6
Midwife	8	22.2
Laboratory technician	3	8.3
Clinical officer	5	13.9
<b>Qualification</b>		
Certificate	15	41.7
Diploma	19	52.8
Degree	2	5.6
<b>Work experience in years</b>		
2-10	28	77.8
11-19	6	16.7
29-37	2	5.6
<b>Previous training about waste management</b>		
Continuous professional development	26	72.2
Workshop	10	27.8
<b>Recent training about waste management</b>		
Less than a month ago	6	16.7
1-6 months ago	21	58.3
7-12 months ago	5	13.9
Over 12 months ago	4	11.1

**Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on Knowledge of Healthcare Workers Regarding Medical Waste Management at Health Center III's in Uganda.**

The knowledge of healthcare workers on management of medical waste was assessed before and after the education intervention (Appendix K and L). A total of 25 questions on the types, recommended color-coded bin, collection, onsite transport, and storage of medical waste were asked. The effect of the education intervention on the knowledge of healthcare workers is reflected in Table 2.

In the pre-intervention phase, 2 (5.6%) of the healthcare workers scored above 80 percent thus were categorized as having excellent knowledge. Twenty eight of the thirty-six healthcare workers (77.7%) scored between 52 and 72%, thus were categorized as having moderate knowledge. Low knowledge was identified in 6 (16.7%) of the healthcare workers with scores ranging from 40 to 48%. During the post-intervention, 100% of the healthcare workers reflected excellent (> 80%) knowledge on medical waste management with scores ranging from 92 to 100%.

Table 2

*The Effect of an Education Intervention on Healthcare workers' Knowledge*

SN	Pre-Intervention		Post-Intervention		Change
	Frequency	Percentage	Frequency	Percentage	
1	10	40	24	96	56
2	16	64	25	100	36
3	13	52	24	96	44
4	12	48	24	96	48
5	15	60	24	96	36
6	15	60	24	96	36
7	13	52	25	100	48
8	15	60	24	96	36
9	11	44	24	96	52
10	16	64	25	100	36
11	10	40	25	100	60
12	14	56	24	96	40
13	19	76	25	100	24
14	14	56	25	100	44
15	15	60	25	100	40
16	21	84	24	96	12
17	13	52	25	100	48
18	12	48	23	92	44
19	14	56	25	100	44
20	15	60	24	96	36
21	16	64	23	92	28
22	17	68	25	100	32
23	20	80	23	92	12
24	16	64	24	96	32
25	15	60	24	96	36
26	13	52	24	96	44
27	15	60	24	96	36
28	18	72	24	96	24
29	18	72	24	96	24
30	14	56	25	100	44
31	14	56	24	96	40
32	14	56	25	100	44
33	15	60	25	100	40
34	11	44	25	100	56
35	17	68	25	100	32
36	18	72	25	100	28

Table 3

*Paired Samples Test*

	Mean	N	Standard Deviation	T	Df	Significance (2-tailed)
Pre	59.1600	25	24.21466			
Post	97.3240	25	2.71267			
Pre-Post	-38.16400	25	22.71185	-8.402	24	.000

A dependent sample t-test was performed to compare the knowledge of healthcare workers regarding medical waste management before and after the education intervention using an individualized rapid assessment tool (Table 3). There was a statistically significant difference in the knowledge of healthcare workers post-intervention (Mean=97.32, SD= 2.71) to knowledge pre-intervention (Mean =59.16; SD = 24.21);  $t(24) = 8.40$ ,  $P=.001$ .

**Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Attitude of Healthcare Workers Regarding Medical Waste Management at Health Center III's in Uganda**

The attitude of healthcare workers regarding management of medical waste was assessed pre and post intervention. A total of 21 questions on perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action and self-efficacy were asked and scored on a four-point Likert Scale of measurement: “Strongly disagree”, “Disagree”, “Agree” and “Strongly Agree (Appendix L). The effect of the education intervention on the attitude of healthcare workers is reflected in Tables 4a, 4b and 4c.

During the pre-intervention, the majority (80%) of healthcare workers had a positive attitude on perceived severity and perceived susceptibility of medical waste with mean scores ranging from 3.53 (SD= 0.91) to 3.69 (SD=0.624). Nine (25%) of the healthcare workers had a

negative ( $m < 3.47$ ) attitude on perceived severity of medical waste management with a mean score of 3.36 (Table 4a). After the education intervention all healthcare workers had a positive attitude ( $m > 3.47$ ) towards medical waste management with mean scores ranging from 3.75 ( $SD=0.439$ ) to 4 ( $SD=0$ ).

Table 4b shows that 75% of healthcare workers had a positive ( $m > 3.47$ ) attitude on perceived benefits and cues to action of medical waste with mean scores of 3.72 ( $SD= 0.566$ ) and 3.78 ( $SD= 0.422$ ) before intervention. Less than 30% of healthcare workers had a negative (mean  $< 3.47$ ) attitude on perceived benefits and cues to action with mean scores ranging from 3.111 ( $SD =0.97$ ) to 3.44 ( $SD=0.735$ ) (Table 4b). After the education intervention, all healthcare workers had a positive attitude ( $m > 3.47$ ) towards the benefits and cues to action of medical waste with mean scores ranging from 3.56 ( $SD= 0.504$ ) to 3.94 ( $SD = 0.232$ ).

Table 4 a

*Effect of an Education Intervention on Health Workers' Perceived Severity and Susceptibility of*

*Medical Waste Management*

Items	Pre-intervention						Post-intervention						Change
	SD	D	A	SA	M	StD	SD	D	A	SA	M	StD	
<b>Perceived Severity Items</b>													
1. Proper medical waste management is a threat to a health facility	25	4	2	5	3.36	1.09	35	1	0	0	3.97	0.17	0.61
2. The consequences of a health worker acquiring a hospital acquired infection are not very severe	19	13	2	2	3.36	0.83	36	0	0	0	4	0	0.64
3. Having a health worker obtain a hospital acquired infection can never cause me trouble	20	16	0	0	3.56	0.50	31	5	0	0	3.86	0.35	0.3
<b>Perceived Susceptibility Items</b>													
4. Inappropriate medical waste management minimizes my risk of acquiring hospital acquired infections	30	1	2	3	3.61	0.93	31	5	0	0	3.86	0.35	0.25
5. Diseases contracted due to inappropriate medical waste management are not often frightening.	25	9	1	1	3.61	0.69	32	4	0	0	3.89	0.32	0.25
6. If I do comply with the waste management guidelines I am likely to contract infections from medical waste.	6	26	1	3	3.53	0.91	33	3	0	0	3.92	0.28	0.39
7. The chance that a health worker can contract hospital infection if I fail to manage medical waste appropriately is very minimal	27	8	0	1	3.69	0.62	27	9	0	0	3.75	0.44	0.06

Table 4b

*Effect of an Education Intervention on Health Workers' Perceived Benefits of and Cues to**Action for Medical Waste Management*

Items	Pre-intervention						Post-intervention						Change
	SD	D	A	SA	M	StD	SD	D	A	SA	M	StD	
<b>Perceived Benefits</b>													
8. Engaging in appropriate medical waste management does not protect the health worker	28	8	-	-	3.78	0.42	23	13	0	0	3.64	0.49	0.14
9. Engaging in proper medical waste management rarely reduces the risk of hospital-acquired infections	17	11	4	4	3.14	1.02	28	8	0	0	3.78	0.42	0.64
10. Proper management of medical waste may increase financial burden on health facility.	16	11	6	3	3.11	0.97	20	16	0	0	3.56	0.50	0.45
11. I feel un comfortable engaging in proper medical waste management practices.	28	6	2	-	3.72	0.57	28	8	0	0	3.78	0.42	0.06
<b>Cues to Action Items</b>													
12. Taking courses in medical waste management increases the chances of a healthcare worker succumbing to hospital acquired infections.	20	8	4	4	3.22	1.05	30	6	0	0	3.83	0.38	0.61
13. Putting a poster in the duty room does not remind health workers to segregate medical waste.	20	13	2	1	3.44	0.74	24	12	0	0	3.67	0.48	0.23
14. Regular monitoring, supervision and use of reminders hinder adherence to medical waste management.	19	10	7	-	3.33	0.79	31	5	0	0	3.86	0.35	0.53
15. Seeing my supervisor managing medical waste appropriately de-motivates me to manage it.	27	8	-	1	3.72	0.51	34	2	0	0	3.94	0.23	0.22

Table 4c

*Effect of an Education Intervention on Health Workers' Perceived Barriers and Self-Efficacy for Medical Waste Management*

Items	Pre-intervention						Post-intervention						Change
	SD	D	A	SA	M	StD	SD	D	A	SA	M	StD	
<b>Barrier Items</b>													
16. Non availability of medical waste management materials makes me adhere to proper medical waste management guidelines	19	14	3	-	3.44	0.65	27	9	0	0	3.75	0.44	0.31
17. The attitude of the health worker towards medical waste management standards does not affect compliance	16	17	1	2	3.31	0.79	31	5	0	0	3.86	0.35	0.55
18. I feel that managing medical waste appropriately is a responsibility of the cleaner and not mine	25	11	-	-	3.69	0.47	32	4	0	0	3.89	0.32	0.2
19. Medical waste management is ineffective especially when staff exhibit teamwork.	18	8	6	4	3.111	1.06	29	7	0	0	3.81	0.40	0.69
<b>Self-Efficacy Items</b>													
20. My behavior does not make a difference in whether a health worker obtains a hospital	15	20	1	-	3.39	0.55	29	7	0	0	3.81	0.40	0.42
21. I segregate medical waste at the point of generation to increase the risk of hospital acquired infections	29	4	3		3.72	0.62	36	0	0	0	4	0	0.28

Table 4 c shows that during the pre-intervention, ninety (90%) percent of the healthcare workers had a positive ( $m > 3.47$ ) attitude on perceived barriers and self-efficacy of medical waste with mean scores of 3.69 (SD=0.467) and 3.72 (SD= 0.615). Eleven (11%) percent of the healthcare workers had a negative ( $m < 3.47$ ) attitude on barrier and self-efficacy of medical waste with mean scores ranging from 3.111 (SD= 1.0631) to 3.44 (SD=0.652). After the education intervention, 100% of healthcare workers had a positive attitude on perceived barriers and self-efficacy of medical waste with mean scores ranging from 3.75 (SD=0.439) to 4 (SD=0)

A dependent sample t-test (Table 5) was performed to compare the means for attitude of healthcare workers regarding medical waste management before and after the education intervention using an individualized rapid assessment tool. There was a statistically significant difference in the attitude of healthcare workers post-intervention (Mean=3.829, SD= 0.1144) to attitude pre-intervention (Mean =3.469; SD = 0.2167), conditions;  $t(20) = 7.422, P=.001$ .

Table 5

*Paired Samples Test*

	Mean	N	Standard Deviation	T	df	Sig. (2- tailed)
Pre	3.469	21	0.2167			
Post	3.829	21	0.1144			
Pre-Post	-0.361	21	0.223	-7.422	20	.000

**Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Practice of Healthcare Workers Regarding Medical Waste Management at Health Center III's in Uganda**

The practice of healthcare workers regarding management of medical waste was observed in two health facilities before and after the education intervention without their knowledge. A total of 13 items were observed. The findings are presented in terms of scores to reflect what was being done before the intervention. Tables 6a and 6b reflect the effect of the intervention.

Table 6a shows observations made in facility one during the pre-intervention. The findings reflected moderate to poor practice < 75% and <50% with scores ranging from 10 to 5. Poor practice of medical waste management was mainly observed in the maternity units. After the intervention, the scores ranged from 12 to 13 reflecting excellent practice (>75%).

Observations made in facility two during the pre-intervention reflected poor practice <50% with scores ranging from 6 to 7. Poor practice was observed in all units. After the intervention, the scores ranged from 11 to 13 reflecting excellent practice (>75%).

Table 6a

*Effect of an Education Intervention on Observed Practice of Medical Waste Management among Healthcare Workers*

Variables	Facility 1					
	Laboratory		OPD		Maternity	
	Pre	Post	Pre	post	Pre	post
1. Used gloves placed in yellow bin with a cover.	1	1	1	1	0	1
2. Used syringes and needles are put in a puncture and leak proof safety box.	1	1	1	1	0	1
3. Used needles are placed in a safety box.	1	1	1	1	1	1
4. Used cotton swabs disposed in yellow bin with cover.	1	1	1	1	0	1
5. Used gauze put in yellow bin with cover.	1	1	1	1	0	1
6. Packaging material/paper waste disposed in black bin with a liner.	1	1	1	1	1	1
7. Waste containers are not filled to the brim.	1	1	0	1	0	1
8. Safety boxes replaced when $\frac{3}{4}$ full	0	1	0	1	0	1
9. Sharps waste is not mixed up with other waste.	1	1	0	1	1	1
10. Unit has color coded bins in place for waste management	0	1	0	1	1	1
11. Unit has puncture resistant safety boxes for used syringes and needles	1	1	1	1	0	0
12. Posters are in place to remind staff to manage medical waste appropriately.	1	1	1	1	1	1
13. Gloves available for staff handling medical waste.	0	1	0	1	0	1
<b>Total</b>	<b>10</b>	<b>13</b>	<b>8</b>	<b>13</b>	<b>5</b>	<b>12</b>

Table 6b

*Effect of an Education Intervention Observed Practice of Medical Waste Management  
Among Healthcare Worker, Pre-and Post-Intervention*

Variables	Facility 2					
	Laboratory		OPD		Maternity	
	Pre	Post	Pre	Post	Pre	Post
1.Used gloves placed in yellow bin with a cover	0	1	1	1	1	1
2.Used syringes and needles are put in a puncture and leak proof safety box	1	1	1	1	1	1
3.Used needles are placed in a safety box	1	1	1	1	0	1
4.Used cotton swabs are disposed in yellow bin with cover	0	1	1	1	1	1
5.Used gauze put in yellow bin with a cover	0	1	1	1	1	1
6.Packaging material/paper waste disposed in black bin with a liner	1	1	0	1	1	1
7.Waste containers are not filled to the brim	0	1	0	0	1	1
8.Safety boxes replaced when $\frac{3}{4}$ full	0	1	0	1	0	0
9.Sharps waste is not mixed up with other waste	0	1	0	0	0	1
10. Unit has color coded bins in place for waste management.	0	1	0	1	0	1
11.Unit has puncture resistant safety boxes for used syringes and needles	1		1	1	0	1
12.Posters are in place to remind staff to manage medical waste appropriately	1	1	1	1	1	1
13.Gloves available for staff handling medical waste	1	1	0	1	0	1
<b>Total</b>	<b>6</b>	<b>13</b>	<b>7</b>	<b>11</b>	<b>7</b>	<b>12</b>

Table 7

*Paired Samples Test*

	<b>Mean</b>	<b>N</b>	<b>Standard Deviation</b>	<b>T</b>	<b>df</b>	<b>Sig(2- tailed)</b>
Pre	55.1167	6	13.22383			
Post	94.8667	6	6.28702			
Pre-Post	-39.75000	6	12.29028	-7.922	5	.001

A dependent sample t-test was performed to compare the practice of healthcare workers regarding medical waste management before and after the education intervention using an individualized rapid assessment tool. There was a statistically significant difference in the practice of healthcare workers post-intervention (Mean=94.9, SD= 6.29) to practice pre-intervention (Mean =55.1; SD = 13.2), conditions;  $t(5) = 7.9$ ,  $P=.001$ .

**Summary**

Chapter Four has presented the findings from the study done with 36 healthcare workers on the effect of an education intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude and practice of health healthcare workers regarding medical waste management. The analysis included the demographic data, and effect of an education intervention based on utilization of individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers, regarding medical waste management at selected Health Center III's in Mukono District.

## **Chapter Five: Discussion**

This chapter provides a discussion of the study results. There is a discussion on the demographic data, effect of an education intervention based on utilization of individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers, regarding medical waste management at Health Center III's in Uganda. The chapter also provides a conclusion, limitations of the study, recommendations and areas for further study.

### **Socio Demographic Characteristics of Healthcare Workers**

Most participants were nurses, of which majority were females. A similar study carried out in southern Iraq found that the number of nurses was more than that of other healthcare workers (Khaled & Ali 2022). Over half of the healthcare workers had received recent training on medical waste management in the last 1-6 months. However, there was no association of previous training with excellent knowledge or positive attitude in the pre-intervention. In a similar study carried out in Southern Iraq, Khaled & Ali (year) found that training was not associated with excellent knowledge or positive attitude.

### **Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on Knowledge of Healthcare Workers Regarding Medical Waste Management at Health Center III's in Uganda**

There was a marked improvement in knowledge of healthcare workers after teaching using an Individualized Rapid Assessment Tool (IRAT). Findings show that the healthcare workers low knowledge scores ranging from 40 to 48% in the pre-intervention improved to excellent with scores ranging from 92 to 100%. Similar findings were obtained in Pakistan where education based on utilization of IRAT excellently improved the knowledge of healthcare workers on medical waste management (Kumar et al., 2019).

In Beirut, Tfaily, & Moussa (2020) used the IRAT to teach healthcare workers how to manage medical waste and they found that the healthcare workers knowledge improved excellently in post intervention. The IRAT focuses on policies, guidelines, roles and responsibilities of healthcare workers regarding medical waste management (Scholz et al., 2015). Teaching with the IRAT helps to remind healthcare workers to segregate, follow the 3/4th fill rule, and to use proper color-coded containers and liners (Sapkota et al, 2014). Healthcare workers are also reminded to collect, handle, transport and store medical waste appropriately (Tfaily, & Moussa, 2020).

### **Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Attitude of Healthcare Workers Regarding Medical Waste Management at Health Center III's in Uganda**

There was an improvement in the healthcare workers attitude on medical waste management after the education intervention. The Health Belief Model helped to increase perceived susceptibility, which shows that these healthcare workers considered themselves susceptible to diseases such as HIV and Hepatitis B, and they recognized them as fatal and deadly. Healthcare workers better understood the consequences of these diseases and were ready to take preventive measures by managing medical waste appropriately. A study from Iran in line with this finding, showed an increase in perceived severity after the education intervention (Sadeghi, Tol, Baikpour, Moradi, & Hossaini, 2018). Raising the knowledge of healthcare workers, correcting misconceptions and providing color coded bins helped to reduce the barriers and increased benefits of preventing HIV and Hepatitis B. Healthcare workers took measures by segregating medical waste at the point of generation, disposing waste in color-coded bins, handling, collecting and storing medical waste appropriately. A study in Iran found that

application of HBM plays an effective role in reducing perceived barriers to hospital acquired infection prevention and increasing perceived benefits in healthcare workers (Sadeghi et al., 2018).

### **Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on the Practice of Healthcare Workers Regarding Medical Waste Management at Health Center III's in Uganda**

Findings show a significant improvement in the practice of healthcare workers regarding medical waste management. The IRAT aimed at re-awakening healthcare workers knowledge, motivating and stimulating their attitude in order to improve waste management practice. Healthcare workers acquired knowledge and skills on medical waste management, and were reminded on: segregation of medical waste, collection, handling, use of proper containers, and 3/4th fill rule in medical waste management. A medical waste management committee was put in place to help in emphasizing the appropriate practice of medical waste management. The committee agreed to meet weekly in order to ensure a sustained medical waste management practice. Posters were put in the critical areas to remind healthcare workers to manage medical waste appropriately. The IRAT helped the health facility administrators to appreciate the benefit of medical waste management. The administrators were able to provide the color-coded bins and heavy duty gloves which were not in place. A study conducted in Pakistan also reported excellent practice of medical waste management following an education intervention based on utilization of IRAT which was attributed to the theoretical understanding that helped the healthcare workers to acquire new skills (Kumar et al., 2019). In Beirut, Tfaily & Mousa (2020) reported that the IRAT improved the poor practice of medical waste management observed in health facilities in pre-intervention to excellent practice in post intervention. The education of

healthcare workers using the IRAT, and individual follow up of healthcare workers enhanced the improvement in practice. This was consistent with results of Scholz et al (2015) who stressed that practices of healthcare workers can be improved by training of healthcare workers using the IRAT.

### **Study Limitations**

This was an interventional study piloted in two health center III's. Consecutive sampling was used to enroll healthcare workers who were willing to commit to the study. It would be better to sample a larger number of healthcare workers using more health centers than just the two. The education intervention and the follow-up was done by one person, this would predispose to researcher bias when following up. At first healthcare workers were hesitant to participate in the study but later on the administrators talked to them about the importance of participating in such a study. The study did not include students and volunteers yet they also generate and handle medical waste.

### **Conclusion**

Utilizing the IRAT to educate HCWs significantly improved the knowledge, attitude and practice of medical waste management. Furthermore, the teaching sessions and individual follow up empowered and motivated HCWs to implement proper medical waste management practices. The HBM helped HCWs to understand the danger of medical waste, their vulnerability to hospital acquired infections, and the benefits of proper medical waste management.

### **Recommendations**

With the re-awakened knowledge and stimulated attitude, healthcare workers can reduce the threat posed by medical waste. There is a great need to regularize educating healthcare workers and there after provide individual follow up to determine whether the practice of

medical waste management is explicit. During the individual follow up the healthcare worker can be guided on how to perform an omitted step. This helps healthcare workers to improve practice where gaps are identified. The researcher recommends that:

The health facilities should adopt the IRAT for regular self-assessment to identify gaps in medical waste management and address them as they occur in order to maintain the recommended medical waste management practice. Nurse leaders should organize quarterly trainings using the IRAT aiming at improving healthcare workers knowledge, attitude and practice. This may lead to safe work places and a health working environment.

This study took six weeks in each health facility. A more extensive study with a large sample size would be required to better assess the knowledge, attitude and practice in respect to medical waste management. This would also yield more generalizable results.

This study was carried out during a short period of time. A longitudinal study measuring healthcare workers knowledge, attitude and practice post training would be stronger with observation.

### **Dissemination**

The researcher shall share findings with the DHO of Mukono district, and the health facilities that took part in the study. Work on limitations/gaps to improve future studies. Also, apply research findings from a local setting to a regional or national level.

### **Areas for Further Study**

Sufficient resources are required to obtain the recommended facilities for appropriate medical waste management. Therefore, the administrators and healthcare workers need to understand the benefits of proper medical waste management to the healthcare staff, patients and the environment. A study to determine the challenges, opportunities, and innovations for

effective medical waste management would be useful. Also, the effect of teamwork on practice of medical waste management could be studied. There is a need to determine the practices and perceptions of healthcare workers regarding infectious medical waste management.

## References

- Akkajit, P., Romin, H., & Assawadithalerd, M. (2020). Assessment of knowledge, attitude, and practice in respect of medical waste management among healthcare workers in clinics. *Journal of Environmental and Public Health, 1*, 1-12. doi: 10.1155/2020/8745472
- Akulume, M., & Kiwanuka, S. N. (2016). Health care waste segregation behavior among health workers in Uganda: An application of the theory of planned behavior. *Journal of Environmental and Public Health, 1*, 1-8. doi: 10.1155/2016/8132306
- Al-Seraty, W. H. H., & Wafaa, G. M. A. (2014). Health belief model based intervention for improving nursing students' knowledge and behavior regarding osteoporosis prevention. *Journal of Biology, Agriculture and Healthcare, 4* (7), 125-131.
- Retrieved from [www.iiste.org](http://www.iiste.org)
- Anozie, O. B., Lawani, L. O., Eze, J. N., Mamah, E. J., Onoh, R. C., & Anozie, R. O. (2017). Knowledge, attitude and practice of healthcare managers to medical waste management and occupational safety practices: Findings from Southeast Nigeria. *Journal of Clinical and Diagnostic Research, 11*(3), 01-04. doi: 10.7860/JCDR/2017/24230.9527
- Asomugha, A. U., Nkem, B. I., & Istvan, K. (2022). Knowledge, attitude and practice of healthcare workers towards medical waste management: A comparative study of two geographical areas. *Journal of Waste Management and Disposal, 5*, 2641-8827. Retrieved from <http://www.scholarena.com>

- Awodele, O., Adewoye, A. A., & Oparah, A. C. (2016). Assessment of medical waste management in seven hospitals in Lagos, Nigeria. *Public Health, 16*, 269-280. doi: 10.1186/s12889-016-2916-1
- Babirye, J., Vuzi, P., & Mutekanga, D. R. (2020). Factors influencing adherence to proper health care waste management practices among health workers in Wakiso district, Uganda. *Journal of Environmental Science and Public Health, 4*, 96-111. doi: 10.26502/jesph.96120088
- Bandura, A., Freeman, W. H., & Lightsey, R. (1977). Self-efficacy: The exercise of control. *Journal of Cognitive Psychotherapy, 13*, 1-12. doi: 10.1891/0889-8391.13.2.158
- Calikoglu, E. O., & Aras, A. (2019). Nurses' knowledge of hospital medical waste management: Areas to improve. *Eurasian Journal of Medicine and Investigation; 3*, 1–6. doi: 10.14744/ejmi.2019.0007
- Chercos, D. H., Dessie, A., & Wami, S. D. (2018). Hospital waste handler's knowledge of health care waste management at Gondar University Hospital: An institutional-based cross-sectional study. *Ethiopian Journal of Health Development, 32*(4), 243-248. Retrieved from <http://www.Users/USER/Downloads/182584-Article%20Text-465110-1-10-20190128.pdf>
- Chisholm, J. M., Zamani, R., Negm, A. M., Said, N., Abdeldaiem, M. M., & Akrami, M. (2021). Sustainable waste management of medical waste in African developing countries: A narrative review. *Waste Management and Research, 39*(9), 1149– 1163. doi: 10.1177/0734242X211029175

- Cozendey-Silva, E. N., Ribeiro-da-Silva, C., Larentis, A. L., Wasserman, J. C., Rozemberg, B., & Teixeira, L. R. (2019). Cross-cultural adaptation of an environmental health measurement instrument: Brazilian version of the health-care waste management rapid assessment tool. *Public Health, 16*(928), 1-12. doi: 10.1186/s12889-016-3618-4
- Deress, T., Jemal, M., Girma, M., & Adane, K. (2019). Knowledge, attitude, and practice of waste handlers about medical waste management in Debre Markos town healthcare facilities, Northwest Ethiopia. *Research Notes, 12*, 146-155. doi: 10.1186/s13104-019-4174-7
- Ellenkil, A. J., Varghese, A., & Mishra, U. (2021). Knowledge, attitude and practices related to biomedical waste management among staff of a tertiary care government teaching hospital in Lucknow. *Medical Research, 2*, 1-10. doi: 10.36106/IJSR/4744430
- Elnour, A. M., Moussa, M. M. R., El-Borgy, M. D., Fadelella, N. E., & Mahmoud, A. H. (2015). Impacts of health education on knowledge and practice of hospital staff with regard to healthcare waste management at White Nile State main hospitals, Sudan. *International Journal of Health Sciences, 9*(3), 317-333. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4633195/pdf/ijhs-9-3-315.pdf>
- Glanz, K., Rimer, B., & Viswanath, K. (2008). *Health behavior and health education: Theory, research, and practice (4<sup>th</sup> ed.)*. San Francisco: Jossey-Bass.

Hosny, G., Samir, S., & El-Sharkawy, R. (2018). An intervention significantly improves medical waste handling and management: A consequence of raising knowledge and practical skills of health care workers. *International Journal of Health Sciences*, 12(4), 57-67. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6040849/>

Indupalli, A. S., Motakpalli, K., Giri, P. A., & Bendigiri, N. A. (2015). Knowledge, attitude & practices regarding bio-medical waste management amongst nursing staff of Khaja Banda Nawaz Institute of Medical Sciences, Kalburgi, Karnataka. *Journal of Community Medicine*, 6(4), 562-565. Retrieved from [www.njcmindia.org](http://www.njcmindia.org)

Janz, N. J., & Marshall, B. (1984). The health belief model: A decade later. *Health Education and Behavior*, 11, 1-47. doi: 10.1177\_109019818401100101

Katusiime, C. (2018). Making healthcare waste management a priority: The reality of solid waste disposal at an urban referral hospital in Uganda. *Journal of Public Health and Disease Prevention*, 1, 2641-8509. Retrieved from <http://article.scholarena.com/Making-Healthcare-Waste-Management-a-Priority-The-Reality-of-Solid-Waste-Disposal-at-an-Urban-Referral-Hospital-in-Uganda.pdf>

Khaled, S. J., & Ali, W. A. A. (2022). Assessment of knowledge, attitudes, and practices of medical waste management for healthcare providers in government hospitals in Basra, southern Iraq. *International Journal of Health Sciences*, 6 (4), 3040–3056. doi: 10.53730/ijhs.v6nS4.9863

- Khalid, S., Haq, N., Sabiha, Z., Latif, A., Khan, M. A., & Yousaf, N. (2021). Current practices of waste management in teaching hospitals and presence of incinerators in densely populated areas. *Public Health, 21*, 1340-1347. doi: 10.1186/s12889-021-11389-1
- Khan, B. A., Cheng, L., Khan, A. A., & Ahmed, H. (2019). Healthcare waste management in Asian developing countries: A mini review. *Waste Management and Research, 37*(9), 863–875. doi: 10.1177/0734242X19857470
- Khani, J. A., Askari, A., Kashfi, S. M., Khiyali, Z., Kashfi, S. H., & Safari, O. (2017). Application of health belief model in prevention of osteoporosis among primary school girl students. *International Journal of Pediatrics, 5*(11), 6017-1029. doi: 10.22038/ijp.2017.25144.2130
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*, 607-610. Retrieved from [https://www.scirp.org/\(S\(351jmbntvnsjt1aadkpozje\)\)/reference/ReferencesPapers.aspx?ReferenceID=1809246](https://www.scirp.org/(S(351jmbntvnsjt1aadkpozje))/reference/ReferencesPapers.aspx?ReferenceID=1809246)
- Kumar, R., Somrongthong, R., & Ahmed, J. (2016). Impact of waste management training intervention on knowledge, attitude and practices of teaching hospital workers in Pakistan. *Journal of Medical Science, 32*(3), 705-710. doi: 10.12669/pjms.323.9903
- Kwikiriza, S., Stewart, A. G., Mutahunga, B., Dobson, A. E., & Wilkinson, E. (2019). A whole systems approach to hospital waste management in rural Uganda. *Public Health, 7*(136), 1-9. doi: 10.3389/fpubh.2019.00136

- Leonard, C. M., Chunga, C. C., Nkaama, J. M., Banda, K., Mibenge, C., & Chalwe, V. (2022). Knowledge, attitudes, and practices of health care waste management among Zambian health care workers. *Global Public Health, 2*, 655-63. doi: 10.1371/journal.gph.0000655
- Letho, Z., Yangdon, T., Lhamo, C., Limbu, C. B., Yoezer, S., Jamtsho, T. (2021). Awareness and practice of medical waste management among healthcare providers in National Referral Hospital. *PLoS ONE, 16*, 243817-25. doi: 10.1371/journal.pone.0243817
- Mathur, V., Dwivedi, S., Hassan, M. A., & Misra, R. P. (2020). Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: A cross-sectional study. *Indian Journal of Community Medicine, 36*, 143-50. doi: 10.4103/0970-0218.84135
- Mbabazi, K. W. (2018). *Assessing compliance with infection prevention and control guidelines among various cadres of healthcare workers at regional referral hospital in Uganda* [unpublished master's dissertation]. Uganda Christian University.
- Ministry of Health (MOH). (2013). *Uganda national infection prevention and control guidelines*. Retrieved from [www.health.go.ug](http://www.health.go.ug)
- Mugabi, B., Hattingh, S., & Chima, S. C. (2018). Assessing knowledge, attitudes, and practices of healthcare workers regarding medical waste management at a tertiary hospital in Botswana: A cross-sectional quantitative study. *Nigerian Journal of Clinical Practice, 21*, 1627-38. doi: 10.4103/njcp.njcp\_270\_17

Muhwezi, L., Kaweesa, P., Kiberu, F., & Eyoku, I. L. E. (2014). Health care waste management in Uganda: A case study of Soroti regional referral hospital.

*International Journal of Waste Management and Technology*, 2(2), 1–12. Retrieved from [http://www.ijwmt.com/IJWMT\\_Vol.%202,%20No.%202,%20April%202014/Health%20Care.pdf](http://www.ijwmt.com/IJWMT_Vol.%202,%20No.%202,%20April%202014/Health%20Care.pdf)

Nimwesiga, G. (2022). Knowledge, attitude and practices of health workers regarding medical waste management in Entebbe Regional Referral Hospital, Wakiso District. A cross-sectional study. *Students Journal of Health Research*, 1, 1-14. doi: 10.1155/2022/2874064

Okechukwu, E. C., Aguora, S. O., & Oparah, A. C. (2019). Knowledge, attitudes/beliefs and practices in medical waste management: An appraisal of Jos North, Plateau State, Nigeria. *International Journal of Research in Humanities and Social Studies*, 2(12), 43-56. doi: 10.21522/TIJPH.2013.08.03

Okechukwu, E. C., Oparah, A. C., & Aguora, S. O. (2017). Assessment of practices and awareness of safety measures of biomedical wastes management among health workers in metropolitan hospitals in Abuja, Nigeria. *Texila International Journal of Academic Research*, 12, 2520-3088. doi: 10.21522/TIJAR.2014.07.02

Olaifaac, A., Govenderbc, R. D., & Ross, A. J. (2018). Knowledge, attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Natal. *South African Family Practice*, 60(5), 137–145. doi: 10.1080/20786190.2018.1432137

- Omoleke, S. A., Usman, N., Kanmodi, K. K., & Ashiru, M. M. (2021). Medical waste management at the primary healthcare centers in a Northwestern Nigerian state: Findings from a low-resource setting. *Public Health in Practice*, 2(92), 1-7. doi: 10.1016/j.puhip.2021.100092
- Onoh, R. C., Adeke, A. S., Umeokonkwo, C. D., Ekwedigwe, K. C., Agboeze, J., & Ogah, E. O. (2019). Knowledge and practices of health-care waste management among health workers in Lassa fever treatment facility in Southeast Nigeria. *Nigerian Medical Journal*, 60, 257-261. doi: 10.4103/nmj.NMJ\_161\_18
- Peterson, S. J., & Bredow, T. S. (2017). *Middle range theories: Application to nursing research (4<sup>th</sup> ed.)*. Philadelphia: Wolters Kluwer Health/Lippincott Williams.
- Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice (8<sup>th</sup> ed.)*. Philadelphia: Lippincott, Williams & Wilkins.
- Pratinidhi, A. K., Zagade, T. B., & Kakade, S. V. (2014). Assessment of effectiveness of educational intervention on practice among biomedical waste handlers. *International Journal of Science*, 3, 285-95. Retrieved from [http://www.scholar.google.com/citations?view\\_op=view\\_citation&hl=en&user=om\\_cBFsAAAJ&citation\\_for\\_view=om\\_cBFsAAAAAJ:YsMSGLbcyi4C](http://www.scholar.google.com/citations?view_op=view_citation&hl=en&user=om_cBFsAAAJ&citation_for_view=om_cBFsAAAAAJ:YsMSGLbcyi4C)
- Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education Monographs*, 2(4), 328-335. doi: 10.1177/109019817400200403
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education and Behavior*, 15, 175-183. doi: 10.1177/109019818801500203

- Sachan, R., Patel, M. L., & Nischal, A. (2012). Assessment of the knowledge, attitude and practices regarding biomedical waste management amongst the medical and paramedical staff in a tertiary health care centre. *International Journal of Scientific and Research Publications*, 2(7), 1-6. Retrieved from [www.ijsrp.org](http://www.ijsrp.org)
- Sadeghi, R., Tol, A., Baikpour, M., Moradi, A., & Hossaini, M. (2018). Assessing the effects of a health belief model-based educational program on knowledge attitudes and practice among patients with pemphigus vulgaris. *Journal of Cosmetics, Dermatological Sciences and Applications*, 4, 244-249. doi: 10.4236/jcdsa.2014.44033
- Sahiledengle, B. (2019). Self-reported healthcare waste segregation practice and its correlate among healthcare workers in hospitals of Southeast Ethiopia. *Health Services Research*, 19, 591-608. doi: 10.1186/s12913-019-4439-9
- Sapkota, B., Gupta, G. K., & Mainali, D. (2014). Impact of intervention on healthcare waste management practices in a tertiary care governmental hospital of Nepal. *Public Health*, 14, 1-8. doi: 10.1186/1471-2458-14-1005
- Scholz, S., Ngoli, B., & Flessa, S. (2015). Rapid assessment of infrastructure of primary health care facilities: A relevant instrument for health care systems management. *Health Services Research*, 15, 183-193. doi: 10.1186/s12913-015-0838-8
- Shabibi, P., Zavareh, M. S. A., Sayehmiri, K., Qorbani, M., Safari, O., & Mansourian, M. (2017). Effect of an educational intervention based on the health belief model on promoting self-care behaviors of type-2 diabetes patients. *Electronic Physician*, 9(12), 5960-5968. doi: 10.19082/5960

- Sharma, N., Hiremath, L. D., Sudeepa, D., & Kiran, K. H. V. (2017). Impact of an educational intervention on knowledge and attitude of biomedical waste management among health care personnel working in a tertiary care hospital of Bengaluru City, Karnataka, India. *International Journal of Community Medicine and Public Health*, 4(12), 4755-4760. doi: 10.18203/2394-6040.ijcmph20175364
- Sofia, S., Wiku, S. T., Hafni, A., & Ratna, I. (2021). Impacts of education's intervention on solid medical waste management in improving knowledge, attitude, and practice of medical health workers. *Britain International of Exact Sciences*, 4, 1-9. doi: 10.33258/bioex.v3i1.375
- Strecher, V. J., DeVellis, B. M., Becker, M. H., & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behavior change. *Health Education Quarterly*, 13, 73-91. doi: 10.1177/109019818601300108
- Stretcher, V., & Rosenstock, I. M. (1997). The health belief model. In Glanz, K., Lewis F. M., & Rimer, B. K., (Eds.). *Health Behavior and Health Education: Theory, Research and Practice* (pp. 71-91). San Francisco: Jossey-Bass.
- Tabash, M. I., Rim, A. H., Aleya, H. M., El-Borgy, M. D., & Bassam, A. (2019). Impact of an educational program on knowledge and practice of health care staff toward pharmaceutical waste management in Gaza, Palestine. *Air and Waste Management Association*, 66, 429-438. doi: 10.1080/10962247.2016.1146638

- Tewabe, A. F., Tiruneh., Abej, Y. A., & Walle, T. A. (2017). Knowledge, practice and barriers of health care wastes segregation among health care providers in university of Gondar comprehensive specialized hospital, Northwest Ethiopia. *Journal of Science and Technology*, 9(4) 7339-7344. doi: 10.26717/BJSTR.2018.09.001847
- Tfaily, M., & Moussa, S. (2020). Assessment of healthcare waste management in hospitals of South Lebanon. *Journal of Health and Wellbeing*, 2, 1-9. doi: 10.54729/2789-8288.1041
- Thirunavukkarasu, A., Al-Hazmi, A. H., Alruwaili, A. M., & Alarjan, A. M. (2022). Knowledge, attitude and practice towards bio-medical waste management among healthcare workers: A Northern Saudi study. *Peer Journal*, 10, 13773—79. doi: 10.7717/peerj.13773
- Tilahun, D., Donacho, D. O., & Zewdie, A. (2023). Healthcare waste management practice and its predictors among health workers in private health facilities in Ilu Aba Bor Zone, Oromia region, South West Ethiopia: A community-based cross-sectional study. *British Medical Journal*, 13, 67752-60. doi: 10.1136/ bmjopen-2022-067752
- United Nations Global Environment Facility. (2009). *Report to the fifteenth session of the conference of the parties to the United Nations framework convention*. Retrieved from <https://unfccc.int/resource/docs/2009/cop15/eng/09.pdf>
- United States Agency for International Development. (2016). *Strengthening high impact interventions for an AIDS-free generation project: Health care waste characteristics in selected facilities in Mbarara District, Uganda*. Retrieved from [https://pdf.usaid.gov/pdf\\_docs/PA00N5JT.pdf](https://pdf.usaid.gov/pdf_docs/PA00N5JT.pdf)
- Wafula, S. T., Musiime, J., & Oporia, F. (2019). Health care waste management among health workers and associated factors in primary health care facilities in Kampala city, Uganda: A cross-sectional study. *Public Health*, 19, 203-210. doi: 10.1186/s12889-019-6528-4

- Wasswa, P., Nalwadda, C. K., Buregyeya, E., Gitta, S. N., & Nuwaha, F. (2015). Implementation of infection control in health facilities in Arua district, Uganda: A cross-sectional study. *Infectious Diseases, 15*, 268-278. doi: 10.1186/s12879-015-0999-4
- Wen-Tien, T. (2021). Analysis of medical waste management and impact analysis of Covid-19 on its generation in Taiwan. *Waste Management and Research, 39*, 27– 33. doi: 10.1177/0734242X2199680
- World Health Organization (WHO). (2017). *Safe management of wastes from healthcare activities. A summary*. Retrieved from <https://apps.who.int/iris/bitstream/handle/10665/259491/WHO-FWC-WSH-17.05-eng.pdf>
- Woromogo, S., Djeukang, G., Moussa, F. E., Antaon, J. S. S., Kort, K. N., & Tebeu, P. M. (2020). Assessing knowledge, attitudes, and practices of healthcare workers regarding biomedical waste management at Biyem-assi District Hospital, Yaounde: A cross-sectional analytical study. *Advances in Public Health, 20*, 1-7. doi: 10.1155/2020/2874064
- Zagade, T., & Pratinidhi, A. (2014). Effectiveness of educational intervention on knowledge and practice among bio-medical waste handlers. *International Journal of Science and Research, 3*(5), 285-295. Retrieved from [www.ijsr.net](http://www.ijsr.net)

### Appendix A: Individualized Rapid Assessment Tool

The Individualized Rapid Assessment Tool (IRAT) was developed in 2009 by the United Nations Global Environment Facility (UN GEF) (128). It was designed specifically for individual healthcare facilities to measure the state of the healthcare waste management system. The tool is composed of: part I and part II. Part I (the interview) include questions in six topic areas: 1) organization; 2) policy and planning; 3) training; 4) occupational health and safety; 5) monitoring, evaluation and corrective action; and 6) financing. Part II (the facility tour) covers questions regarding the waste management process including classification and segregation, waste generation data, collection and handling, color coding and labeling, posters or signage, transportation inside health facility, storage, hazardous chemical, pharmaceutical and radioactive waste, treatment and disposal and wastewater. The tool provides an automatic score at the end of the data collection that is used as a proxy for implementation effectiveness. It takes approximately one hour to complete including an initial interview with the health care waste management coordinator (0.5 hours), tour of the facility and post tour interview with the health care waste management coordinator to review the score (0.5 hours).

SN	Questions	Weight value	Y	N	Score
	<b>Part 1. Initial Interview</b>				
	<b>Organization</b>				
1	In charge of HCWM	5			
2	Permanent committee that deals with HCWM and meets on regular basis	1.5			
3	Roles and responsibilities regarding HCWM made clear to the staff.	1.5			
	<b>Policy and planning</b>				
4a	HCF has written policies dealing with HCWM.	2			
4b	HCF has written plans, manuals, or written procedures dealing HCWM.	2			
5	Policies, plans, manuals, and/or written procedures consistent with national laws, regulations, and any permits.	3.5			

SN	Questions	Weight value	Y	N	Score
6	HCF has a plan for recycling or waste minimization.	1.5			
7	HCF policy explicitly mentions a commitment to protect the environment.	0.5			
8	HCF is mercury-free. OR HCF has a policy or plan to phase out mercury.	1.5			
	<b>Training</b>				
9	HCF has a training program on HCWM for managers, health professionals, waste workers, and auxiliary staff.	5			
10	Training program includes relevant national laws and regulations.	1			
11	Training program includes segregation, collection and handling of sharps waste, use of proper containers and bags for infectious waste, color coding, 3/4th fill rule, use of personal protection equipment by waste workers, transport, storage, and treatment	2			
12	Staffs are trained, including new staff when they begin their employment.	3			
13	Refresher training at least once a year	1			
	<b>Occupational Health and Safety</b>				
14	Policies and plans related to HCWM include occupational health and safety (including policies for NSI or exposure to blood splatter). OR HCF has separate occupational health and safety policies that include needle-sticks and exposure to blood.	3			
15	Workers who collect, transport and treat waste are provided with proper PPE (gloves, shoes or boots, and aprons)	2			
16	Health workers and workers handling waste are given hepatitis and tetanus vaccinations.	2			
	<b>Monitoring, Evaluation and Corrective Action</b>				

SN	Questions	Weight value	Y	N	Score
17	System of internal monitoring or inspection to determine compliance with HCWM requirements.	1			
18	System of taking corrective action when practices or technologies related to HCWM do not meet the requirements.	1			
19	Policies and/or plans are reviewed or updated at least once a year	0.5			
	<b>Financing</b>				
20	HCF has an annual allocation in its budget for HCWM.	4			
21	Current budget is sufficient for HCWM.	2			
22	HCF has a long-term financing plan or mechanism to cover the costs for sustainable HCWM.	0.5			
	<b>Part II. The facility tour (Post-Inspection Tour Interview) Classification and Segregation</b>				
23	Wastes are properly segregated at the source according to different categories.	5			
24	Health workers are familiar with the classification and segregation requirements.	2			
	<b>Waste Generation Data</b>				
25	Amount of total waste and infectious waste produced per day has been measured.	1			
	Percentage of infectious waste relative to total waste	0.5			
	Kilograms un recycled waste per bed per day	0.5			
	<b>Collection and Handling</b>				
26	Used syringe needles are collected without recapping.	2			
27	Sharps wastes are collected in sharps containers or destroyed using needle destroyers.	5			

SN	Questions	Weight value	Y	N	Score
28	Sharps containers are puncture-resistant and leak-proof. OR Needle destroyers are approved under existing regulations or standards.	2			
29	Sharps containers are filled only 3/4th full. OR Needle destroyers are well maintained.	2.5			
30	Sharps containers or needle-destroyers are always available.	1			
31	Sharps containers or needle-destroyers are properly placed such that they are easily accessible to personnel and located as close as possible to the immediate area where the sharps are used.	1.5			
32	Health workers know what to do in the event of a needle-stick injury. OR Health workers are familiar with the policy on needle stick injury.	1			
33	Plastic bags are used for non-sharps infectious waste of good quality. OR Specialized containers that are disinfected, cleaned and reused and do not require plastic bags are used.	1			
34	Plastic bags are always available. OR Specialized containers described in #33 are always available.	1			
35	Bag holders or hard containers holding the plastic bags are of good quality. Specialized containers that are disinfected, cleaned and reused and do not require plastic bags are used.	0.5			
36	Infectious wastes are removed at least once a day.	1			
37	Waste workers know what to do if sharps or infectious waste is accidentally spilled. OR Waste workers are familiar with the spill clean-up plans.	0.5			
	<b>Color Coding and Labeling</b>				
38	HCF uses a system of color coding for different types of wastes.	3			
39	Colors of the waste containers are consistent with the color coding.	2			

SN	Questions	Weight value	Y	N	Score
410	Infectious waste bags are colored or labeled in accordance with the policies or regulations	1			
	<b>Posters or Signage</b>				
41	posters or signs showing proper segregation of healthcare waste	0.5			
	<b>Transportation Inside Health Establishment</b>				
42	Waste is transported away from patient areas and other clean areas.	0.5			
43	Waste is transported in a closed (covered), wheeled transport cart.	1			
44	Transport cart is cleaned at least once a day.	0.5			
	<b>Storage</b>				
45	Storage area meets the proper requirements.	1			
46	Storage area is kept clean.	0.5			
47	Wastes are removed before the maximum allowable storage time is exceeded.	1			
	<b>Hazardous Chemical, Pharmaceutical and Radioactive Waste</b>				
48	Hazardous chemical, pharmaceutical, and radioactive wastes are segregated from infectious and general non-risk wastes.	4			
49	HCF has a plan for treatment and disposal of hazardous chemical, pharmaceutical, and radioactive wastes.	1			
	<b>Treatment and Disposal</b>				
50	HCF treats its infectious waste (either on-site or at an off-site treatment facility)	25			
51	Laboratory cultures and stocks of infectious agents are treated within HCF before being taken away from the facility.	2			
52	Contingency plan for treatment of infectious waste in the event that the	1			

SN	Questions	Weight value	Y	N	Score
	treatment technology is shut down for repair.				
53	Waste is transported safely to the treatment area.	0.5			
54	Treatment area is located in a place that is easily accessible to the waste worker but not accessible to the general public.	0.5			
55	HCF has a program of regular inspection and periodic maintenance of the treatment technology.	3			
56	Treatment system is clean, operating properly, and well maintained.	3			
57	Treatment system destroys or mutilates sharps waste in order to prevent reuse.	1			
58	HCF uses an approved non-incineration treatment technology such as an autoclave-shredder, integrated steam treatment system, or microwave unit.	6			
59	Incinerator meets international standards.	3			
60	PVC plastics are kept out of the waste that is burned.	1			
61	Waste that is treated in an alternative technology is disposed of in a sanitary landfill. OR Incinerator ash is buried in a hazardous waste landfill.	1			
	<b>Wastewater</b>				
62	HCF treats its waste water (liquid waste) before being released. OR HCF is connected to a sanitary sewer that is linked to a wastewater treatment plant.	3			
63	Treated waste water from HCF meets national or international standards.	1			

Developed in 2009 by the United Nations Global Environment Facility (UN GEF)  
(128)

## Appendix B: Questionnaire

Effect of Education Intervention on Knowledge, Attitude and Practice of Health

Workers Regarding Medical Waste Management at Health Center III

(Questionnaire for health workers at health center III)

Date: .....

Questionnaire Number: .....

Dear Respondent, this study seeks to determine the effect of education intervention on knowledge, attitude and practice of health workers (HWs) regarding medical waste management (MWM) at health center III. Study is mainly for academic purposes, and questionnaires will remain anonymous to ensure confidentiality. Please read the questions carefully and respond correctly and tick in appropriate box.

### Section A: Socio-Demographic Characteristics.

1. Age in years
2. Gender Male  Female
3. Profession: Nurse  Laboratory technician   
Midwife  Clinical officer
4. Qualification: Certificate  Diploma  Degree
5. Work experience in years
6. Previous training on waste management (select the most recent)
- Curriculum in the training school  Continuous professional developments
- Workshop
7. When was your most recent training on waste management? (indicate whether weeks, months or years) \_\_\_\_\_

**Section B: Items on Knowledge of MWM.**

Segregation: Match the kind of medical waste with the recommended color-coded waste bin.

Kind of medical waste	Recommended color coded bin				
	Black	Yellow	Red	Brown	Safety box
8. Used canulae					
9. Sputum with blood					
10. 3.Food peelings					
11. Used blades					
12. Catheter tubes					
13. Extracted teeth					
14. Expired drugs					
15. Packaging material/ paper					
16. Placenta					
17. Empty vials					
18. Used gauze					
19. Broken slides					
20. Used infusion sets					
21. Used test kits					
22. Used syringes and needles					
23. Leftover food from patient with hepatitis virus					
24. Used nasal gastric tubes					

**Collection and onsite transportation:** Chose the correct response

25. Waste containers are replaced when
- a) 3/4 full
  - b) 1/4 full
  - c) 1/2 full
26. Staff handling medical waste does wear
- a) Disposable gloves
  - b) Surgical gloves
  - c) Industrial gloves
  - d) Heavy duty gloves
27. Infectious and non-risk medical wastes are collected on
- a) Separate trolley
  - b) Same trolley
28. Waste is collected and taken to a central storage area within
- a) 6 hours
  - b) 12 hours
  - c) 24 hours
  - d) 48 hours
29. Waste is stored at the health facility for a maximum of
- a) 24 hours.
  - b) 48 hours
  - c) 72 hours
  - d) 120 hours
30. Staff may have access to waste storage facility
- a) Incorrect
  - b) Correct
31. Patients may have access to the waste storage facility
- a) Incorrect
  - b) Correct
32. Storage facility can allow access to rodents, insects or birds
- a) Incorrect
  - b) Correct

**Section C: Attitude based on constructs in Health Belief Model**

Please select one of the following: **SD** – for strongly Disagree, **D**-for Disagree, **A**-for Agree, **SA**-for strongly Agree.

<b>Perceived Severity Items</b>	<b>SS D</b>	<b>DD</b>	<b>A A</b>	<b>SS A</b>
& Proper medical waste management is a threat to a health facility				
& The consequences of a health worker acquiring a hospital acquired infection are not very severe.				
& Having a health worker obtain a hospital acquired infection can never cause me trouble				

<b>Perceived Susceptibility Items</b>	<b>SD</b>	<b>D</b>	<b>A</b>	<b>SA</b>
& Inappropriate medical waste management minimizes my risk of acquiring hospital acquired infections				
& Diseases contracted due to inappropriate medical waste management are not often frightening.				
& If I do comply with the waste management guidelines I am likely to contract infections from medical waste.				
& The chance that a health worker can contract hospital infection if I fail to manage medical waste appropriately is very minimal.				

<b>Perceived Benefits</b>	<b>SD</b>	<b>D</b>	<b>A</b>	<b>SA</b>
& Engaging in appropriate medical waste management does not protect the health worker.				
& Engaging in proper medical waste management rarely reduces the risk of hospital-acquired infections				
& Proper management of medical waste may increase financial burden on health facility.				

<b>Perceived Benefits</b>	<b>SD</b>	<b>D</b>	<b>A</b>	<b>SA</b>
& I feel uncomfortable engaging in proper medical waste management practices.				

<b>Cues to Action Items</b>	<b>SD</b>	<b>D</b>	<b>A</b>	<b>SA</b>
& Taking courses in medical waste management increases the chances of a healthcare worker succumbing to hospital acquired infections.				
& Putting a poster in the duty room does not remind health workers to segregate medical waste.				
& Regular monitoring, supervision and use of reminders hinder adherence to medical waste management.				
& Seeing my supervisor managing medical waste appropriately de-motivates me to manage it.				

<b>Barrier Items</b>	<b>SD</b>	<b>D</b>	<b>A</b>	<b>SA</b>
& Non availability of medical waste management materials makes me adhere to proper medical waste management guidelines.				
& The attitude of the health worker towards medical waste management standards does not affect compliance.				
& I feel that managing medical waste appropriately is a responsibility of the cleaner and not mine.				
& Medical waste management is ineffective especially when staff exhibit teamwork.				

<b>Self-Efficacy Items</b>	<b>SD</b>	<b>D</b>	<b>A</b>	<b>SA</b>
& My behavior does not make a difference in whether a health worker obtains a hospital acquired infection.				

<b>Self-Efficacy Items</b>	<b>SD</b>	<b>D</b>	<b>A</b>	<b>SA</b>
& I segregate medical waste at the point of generation to increase the risk of hospital acquired infections.				

End of questionnaire

Thank you very much for your participation in this study.

### Appendix C: Observation Checklist

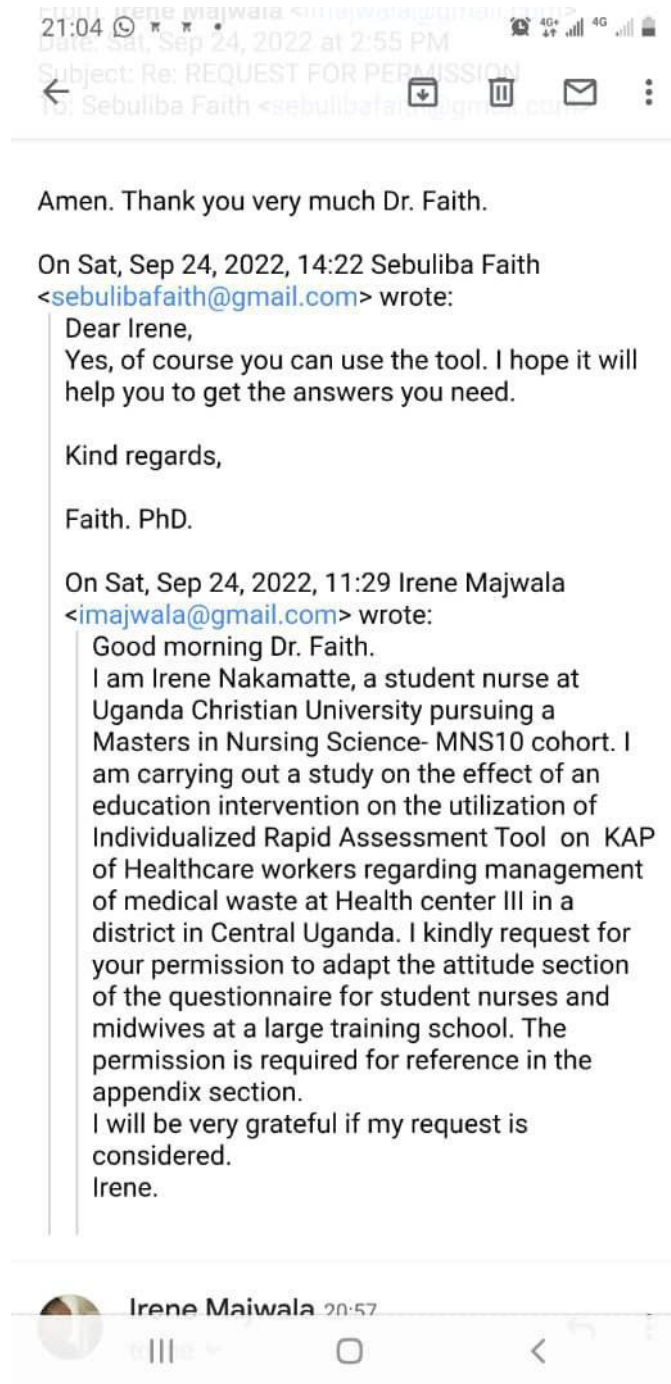
Effect of Education Intervention on Knowledge, Attitude and Practice of  
Healthcare Workers Regarding Medical Waste Management at Health Center III, Uganda  
(Checklist to observe practice of medical waste segregation at health center III)

Date: ..... Unit .....

Checklist Number: .....

Item	Not done	Partially done	Done	Comment
1. Used gloves placed in yellow bin with a cover.				
2. Used syringes and needles are put in a puncture and leak proof safety box.				
3. Used needles are placed in a safety box.				
4. Used cotton swabs disposed in yellow bin with cover.				
5. Used gauze put in yellow bin with cover.				
6. Packaging material/paper waste disposed in black bin with a liner.				
7. Waste containers are not filled to the brim.				
8. Safety boxes replaced when $\frac{3}{4}$ full				
9. Sharps waste is not mixed up with other waste.				
10. Unit has color coded bins in place for waste management				
11. Unit has puncture resistant safety boxes for used syringes and needles				
12. Posters are in place to remind staff to manage medical waste appropriately.				
13. Gloves available for staff handling medical waste.				
<b>Total score</b>				

## Appendix D: Permission from Dr. Sebuliba to Adapt Questionnaire



## **Appendix E: Informed Consent Form for Healthcare Workers Title of the Proposed Study**

Effect of education intervention based on utilization of an Individualized Rapid Assessment Tool (I-RAT) (Appendix A) on knowledge, attitude and practice of health care workers regarding management of medical waste at Health Center III's in Uganda.

### **Principal Investigator**

I am Irene Nakamatte a Master of Nursing Science student at Uganda Christian University Mukono at the faculty of Public Health Nursing and Midwifery. My supervisors are Prof. Karen Drake and Dr. Elizabeth Namukombe Ekong.

### **Background and Rationale for the Study**

Worldwide, the practice of medical waste management is reported to be inappropriate. This has resulted into an increased risk of hospital acquired infections such as hepatitis B, hepatitis C, and HIV/AIDs among the healthcare workers. The WHO developed an individualized rapid assessment tool to promote safety practices and develop safety standards regarding management of healthcare waste. The MOH Uganda developed medical waste management guidelines and protocols concerning management of medical waste but health workers seem reluctant about following proper waste management protocols. Studies show that the individualized rapid assessment tool is highly effective in improving knowledge, attitude, and practices of health care workers regarding management of medical waste.

### **Description of Sponsors of the Research Project**

This research project is being funded by the researcher herself.

### **Purpose of the Study and Why you are Being Asked to Participate**

The purpose of the study is to determine the effect of an educational intervention based on utilization of an individualized rapid assessment tool on knowledge, attitude, and practice of health workers regarding medical waste management at Health Center III's in Uganda. This is a quasi-experimental study that involves implementation of an intervention to support healthcare workers to manage medical waste. I request you to participate in this study as a healthcare worker at health center III to see if the intervention will improve the knowledge, attitude and practice of medical waste management.

### **The Estimated Duration you will Take in the Research Project**

The study will take six weeks and you will be actively involved. In week one and week six, you will be required to fill a pre-test and post-test questionnaire respectively. Four weeks will involve active implementation of the education intervention based on utilization of an individualized rapid assessment tool while carrying out your routine duties.

### **Procedures**

Initially, the practice of medical waste management will be observed at critical sites including the outpatient, treatment and dressing rooms, laboratory and maternity. Participants will complete a pre-intervention questionnaire. Healthcare workers will receive an education session where an individualized rapid assessment tool will be introduced to them. The tool will be used by healthcare workers to perform individual assessment of medical waste management. You will be educated on how to use this tool

before its implementation. Participants will complete a post intervention questionnaire in the last week of the study.

**Risks/Discomforts:**

It is anticipated that you may feel like wasting time and being overworked in the first days of utilizing the individualized rapid assessment tool. To minimize the risk, I will use minimal time as indicated in the consent form. I will teach and demonstrate to you how to use the individualized rapid assessment tool. In addition, I will be available to meet one on one with each participant at each critical site (outpatient treatment room, dressing room, laboratory and maternity) on alternating days to provide clarification or confirmation as issues arise with the tool.

**Benefits**

You will benefit by having updates in knowledge on medical waste management. You will further have a great opportunity explore your potential, amidst challenges or fears while practicing appropriate management of medical waste. The resulting effect of having well prepared healthcare workers may lead to improved outcomes for the healthcare worker, client and the community. As a result, there may be reduced rates of hospital acquired infections and low costs for the health facility.

**Confidentiality**

Confidentiality will be maintained by assigning you a unique number. You will use the same number for pre-test and post-test. You will be the only person aware of your unique number. You will be offered an envelope on which you will write your name and seal the paper with the unique number you will have used for the pre-test, after which you will hand the sealed envelope to the researcher. The researcher will hand the sealed envelope back to you during the post-test, after you can destroy the paper bearing the unique number. The rest of the information will be accessed only by the researcher, her supervisor and the statistician but without knowing who filled what piece of information. In addition, the name of your health facility will not be disclosed on any of your documents.

**Alternatives**

Participation in the study is purely voluntary. You can choose to withdraw from the study before the post-test, a time when the researcher will be able to identify your code without compromising the confidentiality of the rest of the participating healthcare workers. Your decision to drop out of the study will not affect your work or your rights and privileges that come with your working with this health facility.

**Compensation for Participation in the Study**

There will be no compensation for participating in the study. However, during the education session, you will be provided with a handout of the presentation, a brochure, a note book, a pen and a cold drink. Participants may be required to come to the health facility even when they will be off duty. A transport refund of 20,000 Uganda shillings will be given to each participant at the end of the study (after completion of the post intervention questionnaire) to compensate for the transport fare.

**Questions about the study or your rights:**

In case you have any study related questions or questions about your rights as study participant you can reach me by the following means; **Mobile number:** +256 773 181322/ +256 702 029 103 **Email address:** imajwala@gmail.com

Department of Nursing, Faculty of public health, Nursing and Midwifery, Uganda Christian University, PO box 4 Mukono, Uganda.

You could also contact my supervisor Dr. Elizabeth Namukombe Ekong on 0752817166 for further inquiries about the researcher or the topic of study.

**Dissemination of Results**

You will get feedback on findings and progress of the study. Any new information that affects the study or data that has clinical relevance to you (including incidental findings) will be made available to you and/or the head of Nursing at the district.

**Ethical approval:**

This study on the ‘Effect of an educational intervention based on utilization of an Individualized Rapid Assessment Tool on knowledge, attitude and practice of health care workers regarding management of medical waste at Health Center III’s in Uganda’ has been approved by the Research and Ethics Committee (REC) of Uganda Christian University.

**STATEMENT OF CONSENT**

**IRENE NAKAMATTE**...has described to me what is going to be done, the risks, the benefits involved and my rights regarding this study. I understand that my decision to participate in this study will not alter my usual work routine and the rights thereof. In the use of this information, my identity will be concealed. I am aware that I may withdraw at any time before submitting the second questionnaire. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Name ..... Signature of participant .....Date .....

Name ..... Signature of researcher ..... Date .....

## Appendix F: Lesson Plan for the Educational Intervention

**Facilitator:**

**Venue:**

### Lesson plan

Date	Time	Year of study	Subject	Expected number of Healthcare Workers	Number of Healthcare Workers Present
	120 minutes	Research Participants	Medical Waste Management	018	

**Topic:** Effect of an education intervention based on utilization of individualized rapid assessment tool on knowledge, attitude and practice of healthcare workers regarding management of medical waste at Health Center III's in Uganda.

**Objectives:** By the end of the session participants will be able to:

1. Identify the types of medical wastes
2. Explain the public health importance of medical waste management
3. Explain the risks caused by poor management of medical waste
4. Describe waste management principles
5. Outline specific guidelines for management of each type of waste
6. Explain the components of the individualized rapid assessment tool
7. Demonstrate how to correctly use the individualized rapid assessment tool to carry out individual assessment of health facility.

1. Illustrations on power point presentation
2. Brain storming
3. Group discussion
4. Demonstration and return demonstration

**Teaching aids:**

- Video clip on segregation of medical waste
- Power point presentation
- Projector and laptop
- Handouts with information on medical waste management
- Handout with information on individualized rapid assessment tool

- Brochure with information the type of recommended color-coded waste bin, handling of waste, on site transportation, benefits of appropriate medical waste management and the importance of utilizing an Individualized Rapid Assessment Tool.

**References:**

Ministry of Health (MOH). (2013). *Uganda national infection prevention and control guidelines*. Retrieved from [www.health.go.ug](http://www.health.go.ug)

United Nations Global Environment Facility. (2009). *Report to the fifteenth session of the conference of the parties to the United Nations framework convention*. Retrieved from <https://unfccc.int/resource/docs/2009/cop15/eng/09.pdf>

World Health Organization (WHO). (2017). *Safe management of wastes from healthcare activities. A summary*. Retrieved from <https://apps.who.int/iris/bitstream/handle/10665/259491/WHO-FWC-WSH-17.05-eng.pdf>

**Main content**

<b>Time/ Step</b>	<b>Content/ Objective</b>	<b>Teacher's activity</b>	<b>Participants' activity</b>	<b>Remarks</b>
1. 10min	Rapport Introduction of the topic.	Greets Introduces self Introduces topic.	Respond to greetings. Introduce self	
2. 110 min	Identify types of medical waste	Asks participants the types of medical waste  Outline the types of medical waste	Respond  Take note of the types of medical waste	
3. 10 min	Explain the risks caused by poor management	Ask participants the risks caused by poor	Respond by mentioning what they think of the risks	

<b>Time/ Step</b>	<b>Content/ Objective</b>	<b>Teacher's activity</b>	<b>Participants' activity</b>	<b>Remarks</b>
	t of medical waste	management of medical waste  Explain the risks	Take notes of the risks caused by poor management of medical waste	
4. 20min	Describe waste management principles	Ask participants the waste management principles Show a clip on waste segregation Describe the waste management principles	Respond  Watch the video clip  Take notes	
5. 15min	Outline specific guidelines for management of each type of waste	Ask participants to make groups of three, use five minutes to discuss the specific guidelines for management of each type of waste and then present.  Display the specific guidelines	Form groups of three and discuss. The secretary presents findings for each group  Take note of what was missed in the group discussion	
6. 20 min	Explain the components of the individualized rapid assessment tool	Asks participants to brainstorm concerning components of individualized rapid assessment tool	Respond by mentioning what they think are components of individualized rapid assessment tool	

Time/ Step	Content/ Objective	Teacher's activity	Participants' activity	Remarks
		<p>Displays the individualized assessment tool</p> <p>Explains the details</p>	<p>Watch the displayed content</p> <p>Listen to the explanation</p>	
7. 15min	Demonstrate how to correctly use the individualized rapid assessment tool to carry out individual assessment of health facility.	Demonstrates how to use the individualized rapid assessment tool to assess individual health facility	Participants watch, take notes and ask questions at the end of the demonstration.	
8. 15 min	Return demonstration	<p>Asks participants to get into groups of threes, one to volunteer and do return demonstration</p> <p>Moves around the room offering support as necessary</p> <p>Debrief the participants</p>	<p>Participants get into groups of three one volunteer to do a return demonstration</p> <p>Request the facilitator for support as necessary</p> <p>Listen to the debrief</p>	
9. 5min	Summary	Shares a copy of the handout, brochure and the individualized rapid	Receive the handouts, brochure and individualized rapid assessment tool.	

<b>Time/ Step</b>	<b>Content/ Objective</b>	<b>Teacher's activity</b>	<b>Participants' activity</b>	<b>Remarks</b>
		assessment tool for individual health facility assessment Thanks participants		

**Self-evaluation:**

---

---

## **Appendix G: Notes for the Education Intervention**

### **Medical Waste**

This is the total waste stream from health care service delivery or research facilities and includes both potential risk and non-risk waste materials generated during medical activities.

### **Types of Medical Waste**

#### **Non-hazardous (domestic) Medical Waste**

Comprises all the waste that has not been contaminated by blood or body fluids. It is similar to normal household waste. It includes paper, cardboard, non-contaminated plastic or metal, cans or glass and left over food. This category excludes domestic waste from an isolation ward. Non-hazardous medical waste forms the largest component of healthcare waste (80%).

#### **Hazardous Medical Waste**

This is waste with a potential to cause harm to both humans and the environment if exposed or improperly handled or disposed of. Approximately 20% of all healthcare waste is estimated to be hazardous and 1% is estimated to be sharps waste.

#### **Sharps**

Sharps are all objects and materials with puncture or cutting properties such as syringes with needles, blades and broken glass; and pose a potential risk of injury and infection. For this reason, sharps are considered as one of the most hazardous categories of medical waste generated during procedures.

#### **Infectious Waste**

Refers to waste that is typically contaminated with blood or some other body fluid. It is generated in health facility service delivery areas like outpatient departments, injection rooms, patient bedside, and outreach posts.

#### **Highly Infectious Waste**

Includes all viable biological and pathological agents artificially cultivated in significant elevated numbers. Cultures and stocks, dishes and devices used to transfer, inoculate and mix cultures of infectious agents belong to this category of waste. They are generated mainly in Diagnostic Medical Laboratories. This category of waste can also be

generated from isolation wards of hospitals; centers caring for patients infected with Hepatitis viruses; pathology departments, operating theatres and laboratories.

### **Pathological Waste**

Pathological Waste includes body organs (including placentas), tissues as well as blood and body fluids.

### **Anatomical Waste**

Anatomical waste comprises recognizable body parts. It is primarily for ethical reasons that special requirement must be placed on the management of human body parts. They can be considered as a subcategory of Pathological Waste.

### **Pharmaceutical Waste**

This category of waste comprises expired pharmaceuticals or pharmaceuticals that are unusable for other reasons.

### **Effluents**

Hazardous liquid waste that should receive specific treatment before being discharged into the sewerage/drainage system. It is obtained from isolation wards and medical diagnostic laboratories.

### **Public Health Importance of Medical Waste Management**

Currently, health care waste is generated in significantly large volumes and diverse types that require proper handling and disposal. Much of the waste is hazardous and must therefore be properly collected, packaged, stored, transferred, and disposed of safely in order to protect the people that handle it and the environment. All individuals exposed to hazardous medical waste are at a potential risk of being injured or infected. They include:

1. Medical staff and management personnel: doctors, nurses and other Para-medical staffs and hospital maintenance personnel.
2. In-and out-patients receiving treatment in Health Care Facilities (HCFs) as well as their visitors.
3. Workers in support services linked to HCFs such as laundries, waste handling and transportation services

4. Workers in waste disposal facilities, including scavengers
5. The general public and more specifically the children who play with the items that they find in the waste outside the HCFs that are inappropriately disposed of.

### **Risks Caused by Poor Management of Medical Wastes**

Poor management of medical waste causes serious risk to personnel, medical waste handlers, patients, and the community. Sources of illness from infectious waste include injuries from used needles, reuse by other people, and diseases that may result from contact with this dangerous waste. When waste is disposed of in a pit that is not lined, the groundwater may become contaminated. The same water may be used as a source for drinking water.

Burning plastics with organic matter leads to production of toxic gases called persistent organic pollutants (POPs), such as dioxins. These gases are produced mainly when waste is burnt at low temperatures. Their toxic effects have been found to cause cancer among human beings.

If waste is burned or incinerated in an incinerator without emission control, the air may become contaminated by a large number of pollutants and cause serious illness in people who inhale this air. Alternatively, plant life that is important to human life may be destroyed. When choosing a treatment or disposal option, environmental friendliness is an important criterion.

Considering these health impacts, Medical Waste Management is an integral part of health care service delivery. Creating harm through inadequate waste management reduces the benefits of health care. Health care centers must be responsible for management of all waste they generate.

### **Occupational Risks**

During handling of waste, medical and ancillary staff as well as the sanitary laborers can be injured if medical waste has not been managed properly. Sharps are considered as one of the most dangerous categories of waste. Many injuries occur

because syringes and needles or other sharps have not been collected in safety boxes or because safety boxes have been overfilled.

Maintenance workers may also be exposed to pathogens and hazardous medical waste that may be found in drainage systems and chemical stores of the health facility environment.

### **Risks to the Population**

The reuse of syringes is a serious problem in some of the developing countries. WHO estimates that globally, 21 million infections of Hepatitis B, 2 million hepatitis C infections, and 260, 000 HIV infections occur yearly from the reuse of discarded syringes and needles.

The general public gets exposed to medical waste through dumping waste in open areas. This may have adverse effects to the population either directly through needle stick injuries or indirectly through environment pollution by release of poisonous and dangerous gases and emissions.

### **Indirect Risks via the Environment**

As opposed to direct contact with Medical Waste, waste can also contaminate the environment, water, air, or land and therefore can indirectly impact on health.

### **Health-Care Waste Management Principles**

The implementation of safe HCWM guidelines aims at containing infections and reducing public health risks both within and outside the healthcare facility. To this effect, the following key medical waste management steps should be considered:

- Segregation of hazardous medical waste from non-hazardous medical waste.
- Adequate packaging, handling, and safe storage of the different categories of medical waste
- Transportation

### **Waste segregation**

Segregation is one of the most important steps to successfully manage medical waste. Given the fact that only about 10-25% of the medical waste is hazardous, treatment and disposal costs could be greatly reduced if a proper segregation were performed. Segregating hazardous from nonhazardous waste reduces greatly the risks of

infecting workers handling medical waste. Actually, the part of the medical waste that is hazardous and requires special treatment could be reduced to some 2-5% if the hazardous part were immediately separated from the other waste.

The segregation consists of separating the different waste streams based on the hazardous properties of the waste, the type of treatment and disposal practices that are applied. A recommended way of identifying medical waste categories is by sorting the waste into color-coded and well-labeled bags or containers. All the specific procedures of Medical Waste segregation, packaging and labeling should be explained to the medical and ancillary staff and displayed in each department on charts located on the walls nearby the medical waste containers that should be specifically suited for each category of waste.

Segregation should:

- Always take place at the source that is at the ward bedside, Operation Theatre, Medical Analysis Laboratory, or any other room or ward in the hospital where the waste is generated.
- Be **simple** to implement for the medical and ancillary staff and applied uniformly throughout the country.
- Be **safe** and guaranty the absence of infectious medical waste in the domestic waste flow.
- Be **well understood** and well known by the medical and ancillary staff of the healthcare facilities.
- Be regularly **monitored** to ensure that the procedures are respected.

#### **Color coding system**

The application of a color-coding system aims at ensuring an immediate and non-equivocal identification of the hazards associated with the type of medical waste that is handled or treated. In that respect, the color-coding system should remain simple and be applied uniformly throughout the country.

All health- care facilities shall apply the following color-coding system:

1. **Black:** all bins or bags containing non-hazardous medical waste (Household waste).

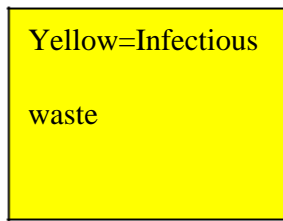
2. **Yellow:** any kind of container filled with infectious medical waste, sharps and radioactive waste.
3. **Red:** any kind of container filled with highly infectious, pathological, anatomical waste, or effluent and heavy metals.
4. **Brown** filled with Pharmaceutical and cytotoxic waste or heavy metals. Include the effluents.

### Color-Coding for Waste Segregation

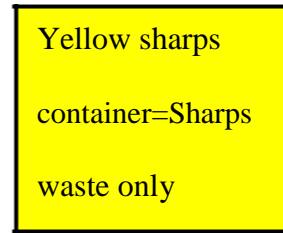
Red=Highly  
infectious waste



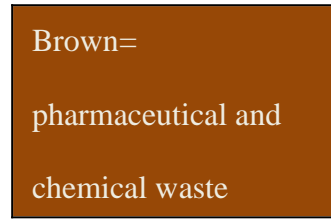
Yellow=Infectious  
waste



Yellow sharps  
container=Sharps  
waste only



Brown=  
pharmaceutical and  
chemical waste



### Medical Waste Packaging

The following guidelines should be included in packaging:

1. Infectious wastes should be contained from the point of origin to the point of treatment where it is rendered non-infectious. The packaging should be appropriate for the type of waste involved.
2. Sharps (sharp items, or items with sharp corners): place sharps in impervious rigid, puncture-resistant containers made of glass, metal, rigid plastic, or cardboard.
3. Liquid infectious waste should be placed in capped or tightly stoppered bottles or flasks and large quantities may be placed in containment tanks.
4. Solid or semisolid waste should be placed in durable, tear resistant plastic bags. The following recommendations should be observed:
  - Do not load bags beyond their weight or volume capacity.
  - Keep bags away from contact with sharp objects.

- Consider double bagging to ensure tear-resistance.

### **Waste storage**

The following guidelines should be included in waste storage:

1. In each health care unit where medical waste is generated, an adequate place shall be dedicated for storing medical waste bags, bins or containers.
2. In all healthcare facilities, separate central storage facilities shall be provided for hazardous medical waste, except radioactive waste that shall be stored separately. It shall clearly be mentioned that the facility stores hazardous medical waste.
3. Health care facilities below level three should store no materials other than yellow bag waste. Highly infectious waste and anatomical waste (except heavy metals and effluent waste) should be disposed of immediately. No waste shall be stored for more than two days before being treated or disposed of. Properly treated waste can be stored up to maximum of one week. Additional guidelines for highly infectious waste should be adhered to like in the case of outbreaks.
4. The designated central storage facility shall be located within the healthcare facility premises close to the treatment unit but away from food storage or food preparation areas.
5. The designated central storage facility should be large enough to contain all the hazardous medical waste produced by the health facility during one week, with spare capacity to cope with any maintenance or breakdown of the treatment unit.
6. The designated central storage facility shall be totally enclosed and secured from unauthorized access.
7. The designated central storage facility shall be inaccessible to animals, insects and birds. The designated central storage facility shall be easy to clean and disinfect and shall have an impermeable hard-standing base, good water supply, drainage and ventilation. The following procedures are recommended:
  - i. All highly infectious waste (red bags) from isolation wards should be disposed of immediately. Infectious Waste should be stored for a minimum of 2 days if not treated and 1 week if treated. The waste should be packaged securely enough to

ensure containment of the waste and to prevent penetration by rodents and vermin.

- ii. Limited access to the storage area is recommended.
- iii. The universal biological hazard symbol should be posted on the storage area door, and waste containers.
- iv. Containers for bio-hazardous material should be a distinctive red color.

### **Waste Handling**

The following guidelines should be included in Waste Handling:

1. All medical waste or disposal of medical equipment shall be disposed of at the point of use by the person who used the item. In case the used equipment is found when not disposed of or handed over to another person for disposal the one who finds it or given the responsibility of disposing it of should do it.
2. All the specific procedures of medical waste segregation, packaging and labeling shall be explained to all health care workers and displayed in each department in chart form and pasted on the walls above the medical waste segregation containers to remind the health worker of what to do.
3. Waste handlers shall wear protective clothing including face masks, aprons and boots, heavy duty gloves, goggles as required when handling waste.
4. Carts that are used repeatedly for transport should be disinfected after each use. Single-use containers should be destroyed as part of the treatment process.

### **Waste Transportation**

#### **Transport to Central Storage**

- ✓ The waste collection trolley should be easy to load and unload. The trolley shall not be used for any other purpose. It shall be cleaned regularly and before any maintenance work is performed on it.
- ✓ Yellow bags of hazardous medical waste and black bags of non-hazardous medical waste shall be collected on separate trolleys that shall be painted and marked with the corresponding color codes. The trolleys shall be washed regularly using a disinfectant and soft brush.

- ✓ collection route shall be the most direct one from the collection point to the central storage.
- ✓ The collected waste shall not be left temporarily anywhere along the way to the storage area other than at the designated central storage.
- ✓ Containers should be covered with lids during storage and transport.
- ✓ Carts should be used for transporting bags of infectious waste within the facility.

### **Specific Guidelines for management of each class of medical waste.**

#### **Class 1: Non-hazardous health-care waste**

- a) Non-hazardous (domestic) waste of class 1 shall be placed in black containers.
- b) Containers should be placed in all rooms, wards and in all public areas.
- c) Non-risk health care waste should be disposed of similarly to domestic garbage and food waste (burning, municipal waste collection, land fill, etc).

#### **Class 2: Infectious waste (clinical waste)**

1. All class 2 clinical waste shall be placed in yellow or red polyethylene bags of minimum 300 microns gauge marked “Danger! Hazardous medical waste” and indicated with the international Biohazard symbol.
2. Preferably, the bags shall be placed in bins or bag-holders.
3. Bags shall be sealed with appropriate adhesive tape, removed and replaced immediately when they are no more than three-quarters full.
4. If not available, yellow bins or containers shall be used; they must nevertheless be systematically disinfected in a solution of 10% of sodium hypochlorite or Lysol once emptied.
5. All class 2 clinical medical wastes shall be incinerated in double chamber incinerators.
6. In highly densely populated areas centralized pyrolytic incinerator, reaching 850 °C and above shall be preferably used.
7. In lower level HCFs, i.e. in health centers and Dispensaries, class 2 clinical waste may be burnt in a simple pit, hole land disposal is an alternative solution when there is no risk of contaminating underground water. Alternately infectious wastes may be buried in a protected pit. However, the pit must be fenced to prevent access.
8. Yellow or red containers for infectious clinical waste should be located in all wards and rooms where infectious waste could be produced. Infectious waste containers should never be placed in public areas.

### **Sharps**

1. All sharps shall be placed in specific cardboard or plastic safety boxes, resistant to punctures and leak-proof, designed so that items can be dropped in using one hand and no item can be removed.
2. The safety box shall be colored yellow, marked “Danger! Or Contaminated sharps”. Yellow is conventionally accepted color and it is advisable to stick to this color. However, in the absence of yellow colored safety box, white ones can be used.
3. The safety box shall be closed when three-quarters full.
4. In particular all disposable syringes and needles shall be discarded immediately following use.
5. The needle shall not be recapped or removed from the syringe; the whole combination shall be inserted in to the safety box. In field situation where there is no safety box, one hand recapping may be acceptable.
6. Under no circumstances are used syringes or needles, or safety boxes to be disposed of in normal garbage or dumped randomly without prior treatment.
7. Sharps are destroyed together with infectious waste. The method of choice for destruction of full safety boxes is incineration, preferably in an appropriate double-chamber (>850°C) incinerator.
8. If such an incinerator is unavailable, alternative methods may be to burn the sharps and throw the cake in medical pits.
9. Under exceptional circumstance, full safety boxes may be destroyed in small numbers by open burning in a fenced hole.
10. Safety boxes must be located in all rooms and wards where injections may be given.

### **Anatomical Waste and Placentas**

In operation theatres, all anatomical waste and placentas shall be collected separately.

- When a centralized incinerator is available, they shall be incinerated.
- Nevertheless, when low-cost incinerators are used, anatomical waste or large number of placentas can be difficult to incinerate and will reduce drastically the performance of the system.
- If incineration cannot be performed, anatomical waste and placentas shall be buried at a sufficient depth (> 1m) inside the healthcare facility compound.

### **Hazardous Pharmaceutical and Cytotoxic Waste**

1. Hazardous pharmaceutical waste and cytotoxic waste shall be repacked in specific boxes cardboard boxes marked “Danger! Hazardous pharmaceutical and cytotoxic waste.” The waste shall be sent to the Medical Store Department that shall ensure their disposal at central level.
2. Class 5 wastes shall be incinerated in a pyrolytic incinerator at a minimum of 1,200<sup>0</sup>C.
3. Class 5 hazardous pharmaceutical wastes and cytotoxic waste containing heavy metals shall not be incinerated.
4. For this specific category of waste, inertization may be foreseen.

### **Highly infectious waste**

1. Highly infectious waste from the medical Diagnostic laboratory of the healthcare facility, such as media and culture plates, shall be collected preferably in leak proof red bags suitable for autoclaving and properly sealed.
2. It shall be autoclaved at a temperature of 121<sup>0</sup>C at 1 bar for at least 20minutes at source, i.e. in the medical Diagnostic laboratory itself.
3. Disinfected waste shall be collected and treated with infectious medical waste.
4. If a distinct autoclave is not available at the medical Diagnostic laboratory to ensure a thermal treatment, highly infectious waste shall be disinfected in 10% solution of sodium hypochlorite in concentrated form and left overnight.
5. It shall then be discarded in a specific red bag properly sealed and itself discarded with infectious medical waste.
6. If none of the above treatment options can be ensured, highly infectious waste should at least be packed in a specific red bag that shall be sealed and directly disposed of with infectious medical waste and this option shall remain exceptional.
7. Highly infectious waste from isolation wards or permanent treatment centers (cholera) shall always be incinerated on-site.

### **Effluents**

1. All liquid infectious waste shall be discharged into the sewerage system only after being treated according to WHO standards.

2. Waste water from healthcare facilities should not be released to the environment without treatment because it may contain various potentially hazardous components such as microbiological pathogens, hazardous chemicals, and pharmaceutical waste and radioactive isotopes.

Appendix H: Power Point

# Medical Waste Management

By

Irene Nakamatte

## Road Map

- Definition of medical waste.
- Types of medical waste.
- Importance of medical waste management.
- Waste management principles.
- Individualized Rapid Assessment Tool.

## Medical waste

### Definition

- **Medical Waste** is the total waste stream from health care service delivery or research facilities and includes both potential risk and non-risk waste materials generated during medical activities.
- **Types of Medical Waste**
- Non-hazardous (domestic) Medical Waste
- Hazardous Medical Waste

## Hazardous Medical Waste

- Sharps
- Infectious Waste
- Highly Infectious Waste
- Pathological Waste

- Anatomical Waste
- Pharmaceutical Waste
- Effluents

## Principles of Medical Waste Management

- Segregation of hazardous medical waste from non-hazardous medical waste.
- Adequate packaging, handling, and safe storage of the different categories of Medical waste
- Transportation

 <b>MEDICAL WASTE SEGREGATION CHART 2015</b>		
<b>SHARPS</b> Red Sharps Container <ul style="list-style-type: none"> <li>✓ Needles</li> <li>✓ Ampoules</li> <li>✓ Broken Glass</li> <li>✓ Blades</li> <li>✓ Razors</li> <li>✓ Staples</li> <li>✓ Trocars</li> <li>✓ Guide Wires</li> <li>✓ Other Sharps</li> </ul> 	<b>BIOHAZARD</b> Red Container w/ Red Liner or Container <ul style="list-style-type: none"> <li>✓ Infectious Waste</li> <li>✓ Blood Products (serum, etc)</li> <li>✓ Contaminated Personnel Protective Equipment (PPE)</li> <li>✓ IV Tubing</li> <li>✓ Cultures, Stocks</li> </ul> 	<b>TRACE CHEMO</b> Yellow Container <ul style="list-style-type: none"> <li>✓ Empty vials, ampoules</li> <li>✓ Empty Syringes, Needles</li> <li>✓ Empty IVs</li> <li>✓ Gowns</li> <li>✓ Gloves</li> <li>✓ Tubing</li> <li>✓ Aprons</li> <li>✓ Wipes</li> <li>✓ Packaging</li> </ul> 
<b>RCRA HAZARD</b> Black Container <ul style="list-style-type: none"> <li>✓ Hazardous meds (PCRA)</li> <li>✓ Half/Partial doses (PCRA)</li> <li>✓ Hazardous Bulk meds</li> <li>✓ Packed drugs, packaging</li> <li>✓ Bulk chemo</li> <li>✓ Pathological Waste (see separate chart)</li> </ul> 	<b>PHARMACEUTICAL</b> Blue Container <ul style="list-style-type: none"> <li>✓ PABs</li> <li>✓ Injectables</li> <li>✓ Antibiotics</li> </ul> 	<b>RADIOACTIVE</b> Sterilized Containers with Radioactive Symbol <ul style="list-style-type: none"> <li>✓ Fluorine-18 (F-18), radiopharmaceuticals</li> <li>✓ Technetium-99 (Tc-99m), radiopharmaceuticals</li> <li>✓ Iodine-131 (I-131), radiopharmaceuticals</li> <li>✓ Strontium-89 (Sr-89), radiopharmaceuticals</li> <li>✓ Iridium-192 (Ir-192), radiopharmaceuticals</li> <li>✓ Cobalt-60 (Co-60), radiopharmaceuticals</li> </ul> 


 Download this Freechart chart at [www.bio-medical-waste.com/Medical-Waste-Disposal/](http://www.bio-medical-waste.com/Medical-Waste-Disposal/)

## Appendix I: Brochure

### IMPORTANCE OF MEDICAL WASTE MANAGEMENT


Safe management of medical waste helps:


- To control and reduce hospital acquired infections.
- Promotes protection of the surrounding environment .
- Reduces further stress on hospital budget.


### Color-Coding for Waste Segregation

Red=Highly infectious waste	Yellow = Infectious waste	Yellow sharps container =Sharps waste
Black = General waste	Brown= pharmaceutical and chemical waste	

## MEDICAL WASTE MANAGEMENT








RELIABLE WASTE MANAGEMENT SOLUTIONS

PO BOX 268, MUKONO  
NABUTI ROAD  
PLOT NO. 008


Phone: 0772282022  
E-mail: imajwala@gmail.com



IRENA WASTE

Tel: 0773181322  
Email: imajwala@gmail.com

### IRENA WASTE



**Vision**

Ensure reliable medical waste management solutions in Mukono District Health facilities

**Mission**

To protect the health and wellbeing of people by providing an affordable waste collection service.

**Values**

- Collaboration
- Sustainability
- Responsibility
- Transparency

### IMPORTANCE OF IRAT

Assesses waste management of individual health facility.


Reduces the disease burden


Promotes best practices and development of safety standards

### Waste Handling

Wear protective clothing.

Dispose waste at the point of generation.






### Transportation of waste

Carts should be used within the facility.

Containers should be covered with lids during storage and transport.



IRENA WASTE

PO BOX 268, MUKONO  
NABUTI ROAD  
PLOT NO. 008

Phone: 0772282022  
E-mail: imajwala@gmail.com

**Appendix J: Individual Follow-Up**

Are there any benefits for the health care worker to utilize the IRAT? What are they?

.....  
.....  
.....

Are there any cost benefits for health facility regarding the utilization of IRAT in medical waste management? What are they?

.....  
.....  
.....

What has your experience been with the utilization of IRAT in medical waste management?

.....  
.....  
.....

What were some of the key drivers to getting the IRAT implemented in waste management?

.....  
.....  
.....

What are some of the challenges in getting the implementation of utilization of IRAT?

.....  
.....

What is your role management of waste using the IRAT?

.....  
.....

What types of differences do you notice with the utilization of IRAT?

.....  
.....  
.....

### Appendix K: Attitude Questions for Pre-intervention

Question	Frequency	Percentage
<b>1. Proper medical waste management is a threat to a health facility</b>		
Strongly Agree	5	13.9
Agree	2	5.6
Disagree	4	11.1
Strongly Disagree	25	69.4
<b>2. The consequences of a health worker acquiring a hospital acquired infection are not very severe</b>		
Strongly Agree	2	5.6
Agree	2	5.6
Disagree	13	36.1
Strongly Disagree	19	52.8
<b>3. Having a health worker obtain a hospital acquired infection can never cause me trouble</b>		
Disagree	16	44.4
Strongly disagree	20	55.6
<b>4. Inappropriate medical waste management minimizes my risk of acquiring hospital acquired infections</b>		
Strongly agree	3	8.3
Agree	2	5.6
Disagree	1	2.8
Strongly disagree	30	83.3
<b>5. Diseases contracted due to inappropriate medical waste management are not often</b>		
Strongly agree	1	2.8
Agree	1	2.8
Disagree	9	25.0
Strongly disagree	25	69.4
<b>6. If I do comply with the waste management guidelines I am likely to contract infections from medical waste</b>		
Strongly agree	3	8.3
Agree	1	2.8
Strongly disagree	6	16.6
Disagree	26	72.2
<b>7. The chance that a health worker can contract hospital infection if I fail to manage medical waste appropriately is very minimal</b>		
Strongly agree	1	2.8
Disagree	8	22.2
Strongly disagree	27	75.0
<b>8. Engaging in appropriate medical waste management does not protect the health worker</b>		
Disagree	8	22.2
Strongly disagree	28	77.8
<b>9. Engaging in proper medical waste management rarely reduces the risk of hospital-acquired infections</b>		
Strongly agree	4	11.1
Agree	4	11.1
Disagree	11	30.6
Strongly disagree	17	42.7
<b>10. Proper management of medical waste may increase financial burden on health facility.</b>		
Strongly agree	3	8.3
Agree	6	16.7
Disagree	11	30.6
Strongly disagree	16	44.4

<b>11.I feel un comfortable engaging in proper medical waste management practices.</b>		
Agree	2	5.6
Disagree	6	16.7
Strongly disagree	28	77.8
<b>12.Taking courses in medical waste management increases the chances of a healthcare worker succumbing to hospital acquired infections</b>		
Strongly agree	4	11.1
Agree	4	11.1
Disagree	8	22.2
Strongly disagree	20	55.6
<b>13.Putting a poster in the duty room does not remind health workers to segregate medical waste</b>		
Strongly agree	1	2.8
Agree	2	5.6
Disagree	13	36.1
Strongly disagree	20	55.6
<b>14.Regular monitoring, supervision and use of reminders hinder adherence to medical waste management</b>		
Agree	7	19.4
Disagree	10	27.8
Strongly disagree	19	52.8
<b>15.Seeing my supervisor managing medical waste appropriately demotivates me to manage it.</b>		
Agree	1	2.8
Disagree	8	22.2
Strongly disagree	27	75.0
<b>16.Non availability of medical waste management materials makes me adhere to proper medical waste management guidelines</b>		
Agree	3	8.3
Disagree	14	38.9
Strongly disagree	19	52.8
<b>17.The attitude of the health worker towards medical waste management standards does not affect compliance</b>		
Strongly agree	2	5.6
Agree	1	2.8
Disagree	17	47.2
Strongly disagree	16	44.4
<b>18.I feel that managing medical waste appropriately is a responsibility of the cleaner and not mine</b>		
Disagree	11	30.6
Strongly disagree	25	69.4
<b>19.Medical waste management is ineffective especially when staff exhibit teamwork</b>		
Strongly agree	4	11.1
Agree	6	16.7
Disagree	8	22.2
Strongly disagree	18	50.0
<b>20.My behavior does not make a difference in whether a health worker obtains a hospital acquired infection.</b>		
Agree	1	2.8
Disagree	20	55.6
Strongly disagree	15	41.7
<b>21.I segregate medical waste at the point of generation to increase the risk of hospital acquired infections.</b>		
Agree	3	8.3
Disagree	4	11.1
Strongly disagree	29	80.6

### Appendix L: Attitude Questions for Post-intervention

Question	Frequency	Percentage
<b>1. Proper medical waste management is a threat to a health facility</b>		
Disagree	1	2.8
Strongly Disagree	35	97.2
<b>2. The consequences of a health worker acquiring a hospital acquired infection are not very severe</b>		
Strongly Disagree	36	100
<b>3. Having a health worker obtain a hospital acquired infection can never cause me trouble</b>		
Disagree	5	13.9
Strongly disagree	31	86.1
<b>4. Inappropriate medical waste management minimizes my risk of acquiring hospital acquired infections</b>		
Disagree	5	13.9
Strongly disagree	31	86.1
<b>5. Diseases contracted due to inappropriate medical waste management are not often</b>		
Disagree	4	11.1
Strongly disagree	32	88.9
<b>6. If I do comply with the waste management guidelines I am likely to contract infections from medical waste</b>		
Disagree	3	8.3
Strongly disagree	33	91.7
<b>7. The chance that a health worker can contract hospital infection if I fail to manage medical waste appropriately is very minimal</b>		
Disagree	9	25.0
Strongly disagree	27	75.0
<b>8. Engaging in appropriate medical waste management does not protect the health worker</b>		
Disagree	13	36.1
Strongly disagree	23	63.9
<b>9. Engaging in proper medical waste management rarely reduces the risk of hospital-acquired infections</b>		
Disagree	8	22.2
Strongly disagree	28	77.8
<b>10. Proper management of medical waste may increase financial burden on health facility.</b>		
Disagree	16	44.4
Strongly disagree	20	55.6
<b>11. I feel uncomfortable engaging in proper medical waste management practices.</b>		
Disagree	8	22.2
Strongly disagree	28	77.8
<b>12. Taking courses in medical waste management increases the chances of a healthcare worker succumbing to hospital acquired infections</b>		
Disagree	6	16.7
Strongly disagree	30	83.3
<b>13. Putting a poster in the duty room does not remind health workers to segregate medical waste</b>		
Disagree	12	33.3
Strongly disagree	24	66.7
<b>14. Regular monitoring, supervision and use of reminders hinder adherence to medical waste management</b>		
Disagree	5	13.9

Strongly disagree	31	86.1
-------------------	----	------

Question	Frequency	Percentage
<b>15. Seeing my supervisor managing medical waste appropriately demotivates me to manage it.</b>		
Disagree	2	5.6
Strongly disagree	34	94.4
<b>16. Non availability of medical waste management materials makes me adhere to proper medical waste management guidelines</b>		
Disagree	9	25.0
Strongly disagree	27	75.0
<b>17. The attitude of the health worker towards medical waste management standards does not affect compliance</b>		
Disagree	5	13.9
Strongly disagree	31	86.1
<b>18. I feel that managing medical waste appropriately is a responsibility of the cleaner and not mine</b>		
Disagree	4	11.1
Strongly disagree	32	88.9
<b>19. Medical waste management is ineffective especially when staff exhibit teamwork</b>		
Disagree	7	19.4
Strongly disagree	29	80.6
<b>20. My behavior does not make a difference in whether a health worker obtains a hospital acquired infection.</b>		
Disagree	7	19.4
Strongly disagree	29	80.6
<b>21. I segregate medical waste at the point of generation to increase the risk of hospital acquired infections.</b>		
Strongly disagree	36	100

### Appendix M: Healthcare Workers Knowledge Pre-intervention

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	F	%	
c	nc	nc	c	nc	c	C	C	e	Nc	nc	e	nc	nc	e	nc	c	nc	nc	c	nc	nc	nc	nc	nc	nc	10	40
c	c	c	c	nc	c	C	C	e	C	nc	e	nc	c	e	nc	nc	c	nc	nc	nc	nc	c	c	c	c	16	64
nc	c	c	c	nc	c	Nc	C	e	C	nc	e	c	nc	e	nc	nc	nc	c	nc	nc	nc	nc	c	c	c	13	52
nc	c	c	c	nc	nc	Nc	C	e	Nc	c	nc	nc	nc	e	c	c	c	c	nc	c	nc	nc	c	nc	nc	12	48
nc	c	c	nc	nc	c	C	C	e	Nc	nc	e	nc	c	e	nc	nc	c	c	c	c	c	nc	nc	c	c	15	60
c	c	c	c	nc	c	C	C	e	C	nc	e	nc	nc	e	nc	c	c	c	nc	nc	nc	c	nc	nc	nc	15	60
nc	c	c	c	nc	nc	C	C	e	nc	nc	e	nc	nc	e	nc	c	c	c	nc	nc	nc	c	c	nc	nc	13	52
nc	c	c	c	nc	nc	C	C	e	c	nc	e	c	nc	e	nc	c	c	c	nc	nc	nc	c	c	nc	nc	15	60
nc	c	c	c	nc	nc	Nc	C	e	c	nc	e	nc	nc	e	nc	c	c	nc	c	nc	nc	nc	nc	nc	nc	11	44
c	c	c	c	nc	c	C	C	e	c	nc	e	nc	nc	e	c	nc	c	nc	nc	nc	nc	c	c	c	c	16	64
c	nc	c	c	nc	nc	e	N	e	e	nc	e	nc	nc	e	nc	nc	nc	nc	nc	nc	c	c	nc	nc	nc	10	40
nc	c	c	c	nc	c	c	C	e	c	c	e	nc	nc	e	nc	c	c	c	nc	nc	nc	nc	nc	nc	nc	14	56
nc	c	c	c	c	nc	e	C	e	c	nc	e	c	c	e	nc	c	c	c	c	c	nc	nc	c	c	c	19	76
nc	c	c	c	nc	c	c	C	nc	nc	c	nc	c	c	nc	c	c	c	nc	c	nc	nc	c	nc	nc	nc	14	56
nc	c	c	c	nc	nc	c	C	nc	nc	nc	e	nc	c	e	c	c	c	c	nc	c	nc	c	c	nc	nc	15	60
nc	c	c	c	c	c	e	C	e	c	c	e	e	c	e	nc	nc	c	c	c	c	c	nc	c	c	c	21	84
nc	c	c	nc	nc	nc	e	C	nc	nc	c	e	nc	c	nc	nc	nc	e	c	c	c	c	c	nc	nc	nc	13	52
c	c	nc	c	nc	nc	nc	C	e	nc	e	c	c	nc	e	nc	c	nc	nc	c	nc	c	nc	nc	nc	nc	12	48
nc	nc	c	nc	nc	c	c	C	e	nc	nc	e	nc	c	nc	c	nc	c	c	c	nc	nc	c	c	c	c	14	56
nc	c	c	nc	c	nc	c	C	e	c	c	nc	nc	nc	c	c	nc	c	c	c	c	nc	nc	c	c	c	15	60
nc	c	nc	c	nc	nc	c	C	e	nc	nc	e	c	c	c	e	c	c	c	c	c	nc	nc	nc	c	c	16	64
c	c	nc	c	c	c	e	C	e	c	nc	e	c	nc	e	nc	c	c	c	c	c	nc	nc	c	nc	nc	17	68
nc	c	nc	c	c	c	e	C	e	c	c	e	c	c	nc	e	c	c	c	c	c	nc	nc	c	c	c	20	80
nc	c	c	c	nc	c	nc	C	e	c	nc	e	nc	nc	e	c	c	c	c	c	c	nc	nc	c	c	nc	16	64

nc	ce	c	nc	nc	cC	c	c	c	c	nc	ce	nc	nc	nc	c	c	nc	nc	nc	c	c	15	60
nc	ce	c	nc	nc	cC	c	c	nc	c	c	nce	nc	nc	nc	c	c	nc	nc	nc	c	c	13	52
c	ce	c	c	c	cC	nc	nc	nc	c	nc	nce	nc	c	c	nc	c	nc	nc	c	c	nc	15	60
nc	ce	nc	c	c	cC	c	c	c	c	nc	ce	nc	nc	c	nc	c	c	c	c	c	nc	18	72
nc	ce	c	c	c	cC	c	nc	c	nc	c	ce	nc	c	c	nc	c	c	c	c	c	nc	18	72
nc	ce	nc	c	nc	ncC	c	c	c	c	nc	ce	c	c	c	nc	nc	c	nc	nc	nc	nc	14	56
c	nce	c	nc	c	cC	c	nc	nc	c	nc	ce	nc	nc	c	nc	c	c	c	c	nc	nc	14	56
c	ce	c	nc	c	cC	c	c	nc	c	nc	nce	nc	nc	nc	nc	c	nc	nc	c	c	nc	14	56
nc	ce	c	c	c	cC	c	nc	nc	c	c	nce	nc	c	c	nc	nc	nc	nc	nc	c	1	15	60
nc	nce	c	nc	c	cC	c	nc	nc	c	nc	ce	nc	nc	c	nc	c	nc	nc	nc	c	nc	11	44
nc	ce	c	nc	nc	cC	c	nc	nc	c	nc	ce	c	nc	c	c	c	c	nc	c	c	c	17	68
nc	ce	nc	c	c	cC	c	c	c	c	c	nce	c	c	c	c	nc	nc	nc	nc	c	c	18	72



c	C	C	cc	cc	c	e	c	e		nc	c	e	c	c	cc	cc	cc	cc	c	24	96
l	C	C	cc	nc	c	e	e	e	e	cc	e	e	e	cc	nc	c	cc	nc	c	22	96
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	cc	cc	nc	c	cc	c	24	96
c	C	C	nc	cc	c	e	e	e	e	cc	e	e	e	cc	cc	cc	cc	c	1	24	96
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	cc	cc	cc	cc	c	1	25	100
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	nc	cc	cc	cc	c	24	96	
c	C	C	cc	cc	c	e	e	e	e	cc	e	e	e	cc	cc	cc	cc	c	25	100	
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	cc	cc	cc	cc	c	25	100	
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	cc	cc	cc	nc	c	24	96	
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	cc	cc	cc	cc	c	25	100	
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	cc	cc	cc	cc	c	25	100	
c	C	C	cc	cc	c	e	e	e	e	cc	e	c	e	cc	cc	cc	cc	c	25	100	

### Appendix O: Participant Attitude Scores for Pre-intervention

No.	Q1	Q2	Q2	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	F	%	
1	3	3	3	3	3	3	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	65	77.4
2	1	3	4	4	4	4	4	4	2	3	4	4	4	4	4	3	4	4	3	4	4	4	75	89.3
3	4	2	4	4	3	4	4	4	3	4	4	4	4	4	3	4	3	4	1	3	4	4	74	88.1
4	3	4	3	2	3	2	3	3	2	3	2	2	3	2	2	2	3	3	2	2	3	3	54	63.4
5	4	1	4	4	4	4	3	4	4	1	4	1	3	2	4	4	4	4	2	4	3	3	68	80.9
6	4	4	3	4	4	4	4	4	4	4	3	4	4	4	3	3	3	3	4	4	3	4	78	92.9
7	2	3	4	4	4	4	4	4	3	2	4	4	1	4	3	3	3	3	4	3	3	4	70	83.3
8	2	4	3	4	3	4	4	3	3	4	4	4	4	3	4	3	4	4	1	3	3	3	71	84.5
9	4	3	4	4	4	3	3	3	3	4	4	4	4	4	4	3	3	3	3	3	3	4	74	88.1
10	4	3	4	4	3	3	4	4	4	1	4	4	4	3	4	4	4	4	4	4	4	4	77	91.7
11	4	4	3	4	3	4	3	4	4	3	4	4	4	3	4	4	4	4	4	3	3	4	77	91.7
12	3	4	4	1	2	4	4	4	4	4	3	3	3	3	3	4	3	4	4	4	3	4	71	84.5
13	4	4	3	4	4	4	4	4	4	3	4	3	4	4	4	4	3	4	3	3	3	4	78	92.9
14	4	4	4	4	4	4	3	3	4	2	4	3	3	3	4	3	3	3	2	3	4	4	71	84.5
15	4	3	3	4	4	3	4	4	3	4	4	3	4	4	4	4	3	4	2	3	2	2	73	86.9
16	1	4	4	1	1	4	4	3	2	3	4	2	2	2	4	2	3	3	4	4	4	4	61	72.6
17	1	4	4	4	4	1	4	4	4	2	3	4	3	2	4	4	4	4	4	4	4	4	72	85.7
18	4	3	3	4	3	3	3	4	3	2	3	3	3	3	3	3	2	3	3	3	3	4	65	77.4
19	4	3	3	4	3	4	1	4	3	3	3	3	4	4	3	3	3	3	3	4	3	4	69	82.1
20	4	4	3	4	3	1	4	4	4	3	3	4	4	3	4	4	4	4	4	4	3	4	75	89.3
21	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	84	100
22	4	2	3	4	4	4	4	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	78	92.9
23	4	4	4	1	4	4	4	4	4	4	4	4	4	4	4	3	4	3	4	4	4	4	79	94
24	4	3	3	2	4	4	4	4	2	4	4	2	3	2	3	3	3	3	4	3	4	4	69	82.1

<b>25</b>	4	3	4	4	4	4	4	4	3	3	4	1	3	2	4	4	3	4	2	3	4	<b>71</b>	<b>84.5</b>
<b>26</b>	4	3	4	4	4	4	4	3	4	4	4	1	4	2	4	4	3	4	1	3	4	<b>72</b>	<b>85.7</b>
<b>27</b>	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	<b>84</b>	<b>100</b>
<b>28</b>	1	3	3	4	4	1	4	4	4	3	4	4	3	4	4	3	1	4	4	3	4	<b>69</b>	<b>82.1</b>
<b>29</b>	4	4	3	4	4	4	4	4	3	4	4	3	4	4	4	3	4	3	4	3	4	<b>78</b>	<b>92.9</b>
<b>30</b>	4	4	4	4	4	4	4	4	1	3	4	4	4	4	4	4	3	4	4	3	4	<b>78</b>	<b>92.9</b>
<b>31</b>	3	4	3	4	4	4	4	3	3	4	4	4	3	3	4	4	3	4	4	4	4	<b>77</b>	<b>91.7</b>
<b>32</b>	4	1	3	4	4	4	4	4	1	1	2	2	3	4	4	4	4	3	1	4	4	<b>65</b>	<b>77.4</b>
<b>33</b>	1	4	4	4	4	4	3	4	3	4	4	4	4	4	4	2	4	4	2	3	2	<b>72</b>	<b>85.7</b>
<b>34</b>	4	4	4	4	4	4	4	4	1	4	4	1	4	4	4	4	4	4	4	4	4	<b>78</b>	<b>92.9</b>
<b>35</b>	4	3	4	4	4	3	4	4	4	2	4	4	3	3	4	3	1	3	4	4	2	<b>71</b>	<b>84.5</b>
<b>36</b>	4	4	4	4	4	4	4	4	4	2	4	4	2	4	4	4	4	4	4	4	4	<b>80</b>	<b>95.2</b>

**Appendix P: Participant Attitude Score for Post-intervention**

<b>No</b>	<b>Q 1</b>	<b>Q 2</b>	<b>Q 3</b>	<b>Q 4</b>	<b>Q 5</b>	<b>Q 6</b>	<b>Q 7</b>	<b>Q 8</b>	<b>Q 9</b>	<b>Q1 0</b>	<b>Q1 1</b>	<b>Q1 2</b>	<b>Q1 3</b>	<b>Q1 4</b>	<b>Q1 5</b>	<b>Q1 6</b>	<b>Q1 7</b>	<b>Q1 8</b>	<b>Q1 9</b>	<b>Q2 0</b>	<b>Q2 1</b>	<b>F</b>	<b>%</b>
<b>1</b>	4	4	4	4	4	4	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>2</b>	4	4	4	4	4	4	4	4	4	4	3	4	4	3	4	4	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>3</b>	4	4	3	4	4	4	4	4	3	3	3	4	4	3	3	4	3	4	3	3	4	<b>75</b>	<b>89.3</b>
<b>4</b>	4	4	4	4	4	4	4	4	4	4	3	4	4	3	3	4	3	4	4	4	4	<b>80</b>	<b>95.2</b>
<b>5</b>	4	4	4	4	4	4	4	3	3	3	3	3	4	4	4	4	4	4	4	4	4	<b>79</b>	<b>94</b>
<b>6</b>	4	4	4	4	4	4	4	4	4	4	3	4	4	3	3	4	3	4	4	3	4	<b>79</b>	<b>94</b>
<b>7</b>	4	4	4	4	4	4	4	3	3	3	3	3	4	4	4	4	3	3	4	3	4	<b>76</b>	<b>90.5</b>
<b>8</b>	4	4	3	4	4	4	4	4	4	3	3	4	4	4	4	3	3	3	4	4	4	<b>78</b>	<b>92.9</b>
<b>9</b>	4	4	4	4	4	4	4	4	3	3	4	4	4	4	4	3	3	4	4	4	4	<b>80</b>	<b>95.2</b>
<b>10</b>	4	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>11</b>	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	<b>83</b>	<b>98.8</b>
<b>12</b>	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	<b>83</b>	<b>98.8</b>
<b>13</b>	4	4	3	4	4	4	4	4	4	3	4	4	4	3	4	4	4	4	3	4	4	<b>80</b>	<b>95.2</b>
<b>14</b>	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	3	4	4	<b>82</b>	<b>97.6</b>
<b>15</b>	4	4	4	4	4	4	4	3	4	4	3	4	4	4	3	4	4	4	4	4	4	<b>81</b>	<b>96.4</b>
<b>16</b>	4	4	4	4	4	4	4	3	3	4	3	4	4	4	4	4	4	4	4	4	4	<b>81</b>	<b>96.4</b>
<b>17</b>	4	4	3	4	4	4	4	4	4	4	3	4	3	4	4	4	4	4	4	4	4	<b>81</b>	<b>96.4</b>
<b>18</b>	4	4	4	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4	3	4	4	<b>80</b>	<b>95.2</b>
<b>19</b>	4	4	4	4	4	3	3	4	4	3	4	4	4	4	4	4	4	4	4	3	4	<b>80</b>	<b>95.2</b>
<b>20</b>	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	3	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>21</b>	4	4	4	3	3	4	4	4	4	4	3	4	4	3	4	4	3	4	4	3	4	<b>78</b>	<b>92.9</b>
<b>22</b>	4	4	4	4	4	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>23</b>	4	4	4	3	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>24</b>	4	4	4	4	4	3	3	3	4	4	4	4	4	4	4	3	4	3	4	4	4	<b>79</b>	<b>94</b>
<b>25</b>	4	4	3	4	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	<b>81</b>	<b>96.4</b>

<b>26</b>	4	4	4	4	4	4	4	4	4	4	3	3	3	3	4	4	4	4	4	4	4	<b>80</b>	<b>95.2</b>
<b>27</b>	4	4	4	4	4	4	4	3	3	3	3	4	4	4	4	4	4	4	4	4	4	<b>80</b>	<b>95.2</b>
<b>28</b>	4	4	4	4	4	4	4	3	4	4	3	4	4	4	4	4	4	3	3	4	4	<b>80</b>	<b>95.2</b>
<b>29</b>	3	4	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	3	4	<b>80</b>	<b>95.2</b>
<b>29</b>	30	4	4	3	3	4	4	4	4	4	4	4	4	4	4	3	4	4	4	3	4	<b>80</b>	<b>95.2</b>
<b>31</b>	4	4	4	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	4	4	<b>81</b>	<b>96.4</b>
<b>32</b>	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>33</b>	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	4	3	4	4	3	4	<b>78</b>	<b>92.9</b>
<b>34</b>	4	4	4	4	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4	4	<b>82</b>	<b>97.6</b>
<b>35</b>	4	4	4	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	3	4	<b>80</b>	<b>95.2</b>
<b>36</b>	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	<b>84</b>	<b>100</b>





# UGANDA CHRISTIAN UNIVERSITY

A Centre of Excellence in the Heart of Africa

UGANDA CHRISTIAN UNIVERSITY

SCHOOL OF RESEARCH & POSTGRADUATE STUDIES

## DISSERTATION CORRECTION COMPLIANCE REPORT BY THE CANDIDATE (POST VIVA FORM)

Date: 28/04/2024

Name of Candidate: IRENE NAKAMATTE Reg. No: RM19M11/008

**Title of Dissertation:** Effect of an Education Intervention Based on Utilization of an Individualized Rapid Assessment Tool on Knowledge, Attitude and Practice of Healthcare workers Regarding Medical Waste Management: A Quasi-Experimental Study at Selected Health Center III's in Mukono District, Uganda.

SN	COMMENTS BY EXTERNAL EXAMINER	ACTION TAKEN	INDICATOR
1	The title indicates that the study was done in Uganda, which is not the case	Edited title to show the study was done in Mukono District	Title with showing a study at selected health center IIIs in

			Mukono district.
2	For sample size determination words and figures too small	Increased the font size	Readable words Page 50
3	Consenting process not done well	Added that "I explained the study aim and methods to the intended participants.	Improved consent process Page 61
4	Some tables in the result section are overcrowded and it is difficult to read them	Changed the format of tables in the attitude section	Readable tables Pages 69, 70, & 71
5	Conclusions not well stated	Removed results from conclusion	A conclusion showing how study objectives were met. Page 81

SN	COMMENTS BY VIVA VOCE PANNEL	ACTION TAKEN	INDICATOR
1	Back ground and introduction was a bit mixed up	Organized the background and introduction	Organized back ground Pages 1-8
2	Please look at your data and present it better.	Removed over 75, 80, and over 90 from the results presented in attitude section	Well presented data Pages 67, 68, 72
3	You looked at only appointed staff how about those not appointed aren't they going to destroy the intervention. If everyone was brought on board, then please say it in your book	In the intervention phase I have mentioned it clearly that all healthcare workers were trained but those who met the inclusion criteria participated in the study.	A clear sentence Page 58
P	Topic; It is quite a mouthful because it gives an impression that you did the study in the whole of Uganda. Please specify that it was in Mukono District and selected HC III's not the whole country	I have specified that the quasi-experimental study was at selected HCIII's in Mukono district.	Title Page
5	After the conclusion, how are you intending on disseminating the findings?	Included the way results shall be disseminated	Dissemination subsection. Page 83

Candidate's Name: Irene Nakamatte Supervisor's Name: Dr. Elizabeth Namukombe Ekong Signature:

Date: 29-04-2024

Signature: 