ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICEOF HEALTHCARE WORKERSABOUT HOSPITALWASTE MANAGEMENT: A COMPARATIVE STUDY OF ZEWDITU AND MCM HOSPITAL, ADDIS ABABA, ETHIOPIA

MBA THESIS

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Declaration

I declare that this thesis is the result of my work and that all sources of materials used are duly acknowledged. This work has not been submitted to any other university for achieving any academic degree or diploma awards.

Name _____

Signature_____

Place: Addis Ababa, Ethiopia

Date of submission_____

This thesis is dedicated to my husband Mr.ZenayenehGirma.

Approval Sheet -1

This is to certify that the thesis prepared by Seble Lemma, ID. SGS/0057/2010B, entitled: **Assessment of knowledge, attitude and practice of healthcare workersabout hospital waste management: A comparative study of Zewditu and MCMhospital, Addis Ababa, Ethiopia,** and submitted in partial fulfilment of the requirements for **the degree of masters of business administration in General Management (MBA)** complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

The assistance and the help received during the course of this investigation have been duly acknowledged. Therefore, I recommend that it can be accepted as a fulfilment of the thesis requirements.

BerhanuEndeshaw (Dr.)		25 Sept 2020
Name of Advisor	Signature	Date

Approval Sheet -2

We, the undersigned, members of the Board of Examiners of the final open defence by Seble Lemma Bedada have read and evaluated her thesis entitled "**Assessment of knowledge, attitude and practice of healthcare workersabout hospital waste management: A comparative study of Zewditu and MCMhospital, Addis Ababa, Ethiopia**" and examined the candidate. This is therefore to certify that the thesis has been accepted in partial fulfilment of the requirements for **the degree of masters of business administration in General Management (MBA)**

Name of Chair Person	Signature	Date
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Name of External Examiner	Signature	Date

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List of Abbreviations and Acronyms

BMW…….	Biomedical Waste
BMWM…….	Biomedical Waste Management
BSc…….	Bachelor of Sciences
DRERC…….	Departmental Research and Ethics Review Committee
FEPA…….	Federal Environmental Protection Authority
FMOH……	Federal Ministry of Health
HBV……...	Hepatitis B virus
HCFs…….	Health Care Facilities
HCPs…….	Health Care Professionals
HCV……...	Hepatitis C virus
HCWs……	Health Care Workers
HIV……	Human Immunodeficiency Virus
KAP……...	Knowledge Attitude and Practice
SPSS ……	Statistical Package for Social Sciences
WHO……..	World Health Organization
PPE……	Personal Protecting Equipment
GOs……	Governmental Organizations
NGOs…….	Non- Governmental Organizations

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ABSTRACT

Background: Health care workers produce various types of waste in the course of rendering health care services. Each classification of waste must be disposed according to the prescribed guidelines. Improper disposal of waste may pose a danger to employees, patients and the environment and have become an emerging problem worldwide**.**

Objectives: To determine the knowledge, attitude and practice of health care workers on medical waste disposal and the associated factors at Zewditu and MCM hospitals at Addis Ababa, Ethiopia.

Methods: A cross-sectional study was employed and data was collected through structured self-administered questionnaires and observational checklists and entered into SPSS version 23 for analysis. Correlations and multiple linear regressions were computed. Variables with a value of <0.05 in the multiple linear regression analysis were considered to explain the presence of statistically significant associations.

Result: The KAP scores among Zewditu hospital health care workers were higher than that of MCM. Furthermore, the major factors that affect the knowledge of HCPs was identified as the level of education and the practice of HCPs was affected by professional categories of HCPs, availability of gloves and color- coded bins (black, yellow and safety box) by the hospital.

Conclusion and recommendation: The level of knowledge, attitude, and practice scores were moderate among Zewditu hospital healthcare workers and inadequate at MCM. Training on waste management should be given to healthcare professionals; regular follow up on the implementation of Infection Prevention (IP) guide should be done, latest waste disposal such as autoclaving and microwaving must be planted to safely dispose biomedical wastes.

CHAPTER ONE

1. ORIENTATION OF THE STUDY

1.1. Introduction

The waste disposal management in HealthCare Facilities (HCFs) are poor and need improvements. HCFs generate wastes which are of great concern due to their potential hazard and health risks if not properly managed. Inadequate and inappropriate handling of HealthCare Workers (HCWs) may have serious public health consequences and a significant impact on the environment. For example, injuries, transmission of infections, environmental pollution, fire hazards, and public nuisance are the major risks of poorly managed HCWs (Muduli and Barve, 2012; Kuroiwa, Suzuki, Yamaji et al., 2004; FMoH, 2012a).

Improper healthcare waste management (HCWM) can also expose healthcare workers, patients, and the community to blood-borne pathogens. Recent studies indicate that as much as 33 percent of Hepatitis B virus and 42 percent of Hepatitis C virus infections arise from direct or indirect exposure to infectious wastes (WHO, 2005). However, in most countries, including Ethiopia, there is little or no knowledge and capacity of managing, treating, recycling or disposing of hazardous wastes. Instead, mass incinerations of HCW are a common practice which creates a great threat to the generl public. Although, there are several technologies for the treatment of HCW, such as, incineration, autoclaving, hydro-claving, microwaving and chemical disinfection (Pruss, Giroult, Rushbrook et al., 1999), the problem of how to manage HCW is worse than ever and the endless generation of HCW has been increasing due to poor management. In this regard, Ethiopia is not exceptional in the high HCW generation rates compounded by poor handling has been a common phenomenon (Tesfahun, 2015; FMoH, 2012b; Muluken, Haimanot, and Mesafint, 2013).

The knowledge, attitude and practices of Healthcare Professionals (HCPs) are very important while managing medical waste. Therefore, education of HCPs, staff implicated in waste collection, patients, and attendant on medical waste are very important. Adequate knowledge, positive attitude and good practice (KAP) of health care workers (HCWs) are key factors for having successful Biomedical Waste Management (BMWM) system as they are important preconditions to safe guard the community and environment from being contaminated with infectious substances. So, in this particular study the focus is to see the level of KAP among HCPs and improvement strategies by comparing public and private hospitals.

1.2. Background of the study

Health care facilities while engaging in life saving activities, they generate wastes and by-products that may be hazardous to human beings or to the environment which need to be handled safely and disposed properly in an environmentally friendly manner (Pinto, Joshi, Velankar*et al*., 2014). According to world health organization (WHO), wastes produced by the health-care providers are broadly categorized as general (non-hazardous) and hazardous waste. General waste constitutes about 85% of the total waste produced in the health care facilities (HCFs) and it is comparable to domestic waste. This type of waste does not pose any risk to human being.

The remaining 15% is however considered as hazardous which may pose a variety of environmental and health risks. Among this, about 10% is considered as infectious (biologically hazardous) while the remaining 5% regarded as hazardous but not infectious (WHO, 2014). Biomedical waste (BMW) is the waste which is generated during diagnosis, treatment or immunization of human beings or animals that may be contaminated with patients' body fluid which includes syringes, needles, ampoules, dressings, disposable plastics and microbiological wastes (Ola-Adisa, Mangden, Sati, et al., 2015). The public health impacts of healthcare waste are determined by the overall waste management strategy adopted by the hospitals or health centres. If the infectious component gets mixed with the general non-infectious waste, the entire mass becomes potentially infectious. The healthcare institutions should be responsible to ensure that there are no adverse health and environmental consequences as a result of their waste handling, treatment and disposal activities. As many HCFs are located at the centre of the city, their waste could be a threatening to the public and they need a continuous health education program for HCPs in order to practice safe methods of medical waste handling and management. Inadequate training of healthcare workers and negligence in implementation of legislations and rules will cause unsafe disposal of medical waste and could lead to serious impacts on the environment and community health (Pruss, Giroult, Rushbrook, et al., 1999).

Therefore, to develop reliable HCWM system critical assessment of existing HCFs waste management practice and KAP among HCWs is unquestionable. Furthermore, there were limited studies that describe the KAP of HCW in comparison with public and private hospitals. Hence, the aim of this study is to assess the knowledge, attitude and practices of HCPs, identify factors associated with better knowledge and practices of health staff in relation to medical waste management.

1.3. Statement of the problem

Healthcare waste management has been identified as a major problem confronting developing countries. Generation and disposal of BMWs has become an emerging problem worldwide and its management is still at infancy and got attention recently due to increased awareness about human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and other potential infectious diseases (Kumar, Singh, Umesh et al., 2013).

A systematic review of 150 articles published since 2000 revealed that at least 50% of the world population is threatened by environmental, occupational and public health risks due to poor management of health care wastes (Caniato, Tudor, Vaccari et al., 2015). 10-25% of BMWs produced by health-care providers are hazardous (WHO, 2014). However; generation rate of hazardous BMW in Ethiopia is unacceptably higher compared with some other countries and threshold set by WHO (Hayleyesus and Cherinete, 2016; Taddese and Kumie, 2014). BMWs could transmit more than 30 dangerous blood borne pathogens (Sawalem, Selic, Herbell et al., 2009), with particular concern for HIV, HBV and HCV infections, for which there is strong evidence of their transmission through needle stick/sharp injury due to poor waste management. It is estimated that more than 2 million HCWs are exposed to percutaneous injuries with infected sharps every year (WHO, 2014).

All individuals, especially healthcare staffs who are exposed to BMWs are potentially at risk However, the highest rate of occupational injury among HCWs exposed to BMWs are reported mainly in the cleaning personnel. Cleaners are usually poorly educated; untrained and little attention is paid to their comfort and safety. It is uncommon for them to have vaccination or proper protective equipment (Medical waste and human rights, 2011). Poor BMWM is a problem in most developing countries and many researchers argued successful BMWM represents a challenge in their countries due to lack of awareness and trained clinical staffs in waste management. In addition, absence of BMWM guideline, legislation and unavailability of suitable treatment and disposal options may further obstruct waste management efforts (Hossain, Santhanam, Norulaini et al., 2011).

Several studies in Africa indicated that BMWM is still in its infancy; characterized by the lack of awareness on the impacts of BMWs, total absence of medical waste regulations.

Thus, the problem of BMW disposal in the hospital and other health care establishments has become an increasing issue of concern. Despite the risk it imposes, BMWM in Ethiopia is a neglected activity by health service providers and lacked the attention it deserves.

Safety is an important element of quality system essentials and studies in the area of BMWM have been wide internationally. However, exploring the dynamics of KAP and associated factor scenarios especially in developing countries including Ethiopia have been so far overlooked. Credible evidences showed that BMWM across Ethiopian health institutions are still inadequate (Azage and Kumie, 2010). Studies conducted so far were mainly focused on waste generation rate and its management at a facility level while assessment of KAP and associated factors among HCWs were left behind especially among cleaners who play a critical role on reducing bio-hazardous associated risks. Studies conducted did not specifically report their result among professional categories of HCWs to establish specific strategy to mitigate issues related mismanagement of BMWs. The current study aimed at filling these gaps and will help to different organizations, stakeholders and policy makers to correct and improve the existing situation of HealthCare waste legislation and enforcement.

1.4. Research Questions

1- What is the knowledge, attitude and practices of health care workers on BMWM at Zewditu (public) and Myungsung Christian Medical Centre (MCM) (private) hospitals?

2- What are the associated factors that affect the knowledge, attitude and practice of healthcare workers on BMWM at Zewditu (public) and Myungsung Christian Medical Centre (MCM) (private) hospitals?

3- What are the associations between knowledge, attitude and practice?

1.5. Objectives of the Study

1.5.1. General objective

- To determine the knowledge, attitude and practice of healthcare workers about bio-medical waste management at Zewdituand MCM hospitals at Addis Ababa, Ethiopia

1.5.2. Specific objectives

- To identifythe knowledge, attitude and practice of healthcare workers about bio medical waste management at Zewditu and MCM hospitals
- To identify the factors that are associated with knowledge, attitude and practice of HCWs
- To determine the association between knowledge and practice, attitude and practice of health care workers on medical waste management at Zewditu and MCM hospitals.

1.6. Significance of the Study

The findings from the study will benefit clients, health care worker, health care facility managers, researchers, policy makers and other stakeholders as outlined below.

- It provides information for HCFs to identify KAP among health care workers and factors contributing to noncompliance (agreed treatment plan) with waste management guideline so that the health care facilities could design targeted interventions to ensure safety of the patients it serve its staffs and other clients.
- It provides information for policy makers and stakeholders about existing situations of BMWM to plan measures to mitigate improper waste management
- It also gives information for researchers who would like to conduct detailed and comprehensive studies either in public or private health institutions.

1.7. Scope of the Study

The study was focused on one public and one private General Hospitals found in Addis Ababa city for comparing the waste management knowledge, attitude and practice among healthcare staffs. Only BMWs generated from health care delivery sections were studied which means, wastes generated from offices, kitchen houses and outside HCFs where been excluded from the study. In this study, wards, outpatient departments (OPDs), laboratory rooms, emergency rooms, operation room, and endoscopy room which potentially generate BMWs wastes were studied.

This study was also limited to assess solid BMWs (blood or its derivative contaminated substances) such as; dressing, gauze, cotton, used intravenous sets, gloves, used specimens or their containers, needle and syringe and so forth. Health care professionals who involved in the generation/segregation of BMWs (Laboratory technicians, Nurses, Medical doctors, Health officers (HOs) and Midwifes) and cleaners responsible for (collection, transportation, storage, treatment and disposal) of BMWs were the study participants. Those HCPs were selected on the ground that they are the prominent producers of BMW and responsible for its segregation. Other HCWs were excluded from the study either due to their number or low involvement in BMWM. In addition, a three-bin system of waste segregation and only on-site waste treatment was assessed to suite different levels of HCFs.

1.8. Organization of the Study

The research report is organized into five chapters. The first chapter is an introductory part which focuses on background/ rational of the study, statement of the problem, significance, objectives, research questions, scope of the study and organization of the paper. Chapter two deals with review of relevant literatures both theoretical and empirical review, chapter three outlines the analytical framework and research methodology, chapter four is data presentation, interpretation and analysis, the last chapter is devoted to provide limitation of the study, conclusion and recommendation.

1.9. Operational Definitions and Terms

Knowledge	:	Ability of study participants to respond BMWM questions designed to assess knowledge and it is measured in terms of knowledge scores.
Attitude	:	Study participants' personal optimistic opinion, outlook or idea
Practice	:	It is a way of doing something in an expected way in a particular situation.
Bio-medical waste	:	waste which is generated during diagnosis, treatment or immunization of human beings or animals or research activities
Biomedical waste management	:	A process that helps to ensure proper health care facility hygiene and safety of health care workers and the community.
Waste segregation	:	Systematic separation of wastes generated from the HCFs according to their type (non-infectious, infectious and sharps) using colour-coded containers for specific treatment and disposal requirements.
Colour-coding	:	A system for relating the contents of waste containers by using different colours.
Biohazard symbol	:	A symbol that is universally recognized as a warning against substances that poses a threat to human health.
Waste disposal	:	Waste disposal is the final placement of treated wastes using environmentally acceptable methods of final storage (burial, deposit, discharge, dumping, placing or release of any waste into or onto the environment) appropriate to national requirements.

1.10. Ethical Considerations

Ethical approval was obtained from Addis Ababa public health research and emergency management directorate. And other permission for carrying out the study were obtained from both hospitals Administration/Medical Directors, study participants have been informed about the purpose of the study, confidentiality also were maintained at all levels of the study, participants' involvement in the study were on voluntary basis and participants who were unwilling to participate in the study and those who wish to quit their participation at any stage were informed to do so without any restrictions.

1.11. Dissemination of the Result

Results of this study were presented in the form of thesis defence at St. Marry University, School of Graduates. Finally, the hard copies of the study were distributed to St. Marry University, School of Graduates, Zewditu Memorial Hospital, MCM General Hospital and Addis Ababa public health research and emergency management directorate, Addis Ababa, Ethiopia

Summary

This chapter outlined the introduction and background of the study, research aim, research question, and research objectives, significance of the study, scope of the study, organizations of chapters and ethical considerations. Chapter 2 will discuss literature review in full.

CHAPTER TWO

2. REVIEW OF THE LITERATURE

2.1. Introduction

In this chapter the literature reviewed was on types of medical waste, knowledge, attitude and practices, environmental and health impact of practices. Literatures related to KAP of BMWM both at global and regional levels were reviewed and discussed with Ethiopian perspective.

2.2. Theoretical framework

Types of medical waste

Medical waste is categorised into different types, namely: infectious waste, pathological waste, sharps, pharmaceutical waste, chemical waste, radioactive waste, cytotoxic agents and human or anatomical waste. Infectious waste is any waste contaminated with viable micro-organisms capable of transmitting a disease. Pathological waste includes body fluids, secretions and surgical specimens. Sharps are any objects capable of inflicting a penetrating injury, which may or may not be contaminated with blood and or body substances. This includes needles and any other sharp objects or instruments designed to perform penetrating procedures.Solid medical waste has been referred to as any discarded solid material generated from activities involving health protection, medical diagnosis, treatment, scientific research, dental and veterinary services (US Congress Office of Technology Assessment, 1988; Coker, Sangodoyin, Sridhar et al., 2009). Human or anatomical waste is waste consisting of tissues, organs, body parts, products of conception and animal carcasses (Health Professions Council of South Africa, 2008).

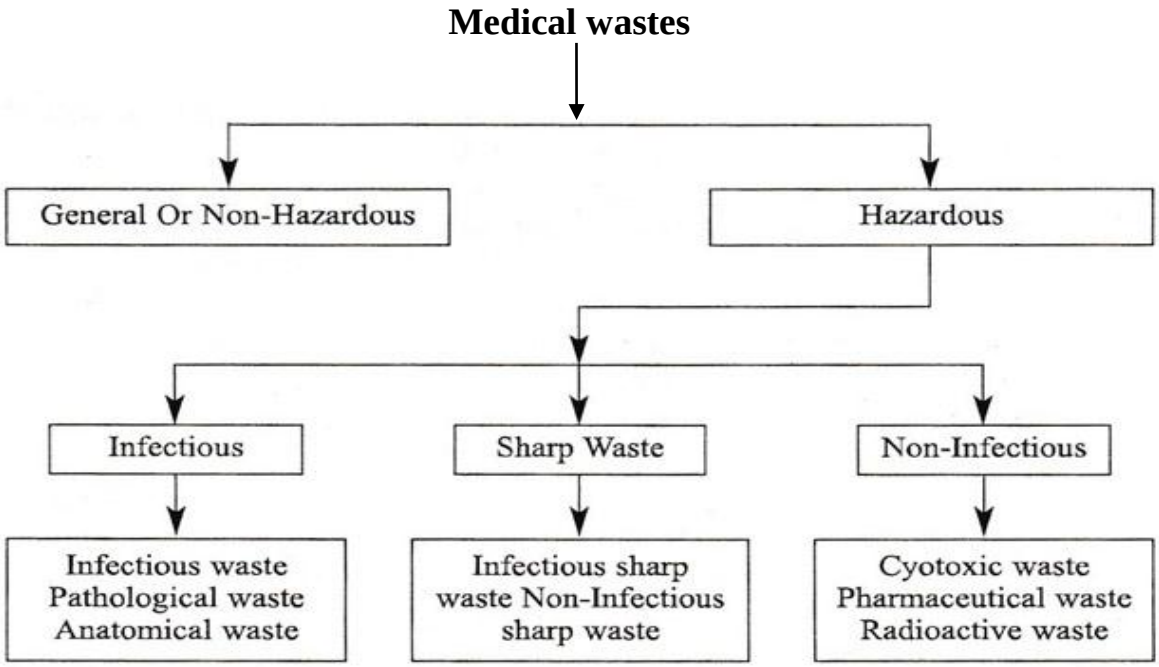

Figure 1: Types of Medical Wastes

Biomedical waste sources

The sources of biomedical waste can be categorized as primary and secondary sources according to the quantities produced. While minor and scattered sources may produce some biomedical waste in categories similar to Bio medical waste, their composition will be different as shown in the table below.

Table 2.1: Primary and Secondary Sources of Generation of Biomedical Waste

Primary sources		**Secondary sources**
Hospital	Medical College	Clinics
Nursing Home	Immunization centres	Ambulance services
Dispensaries	Nursing home	Home treatment
Maternity home	Animal research centres	Slaughter houses
Dialysis centre	Blood Banks	Funeral services
Research lab	Industries	Educational institutes

Source: *Anurag, Tiwari, Prashant et al., 2014***Biomedical waste management process**

Proper biomedical waste management (BMWM) includes vital steps (segregation, collection, storage, transportation, treatment, and final disposal) of wastes generated in the healthcare establishments (Asadullah, Karthik, Dharmappa et al., 2013). Stages which require special attention are stipulated in **Figure 2**.

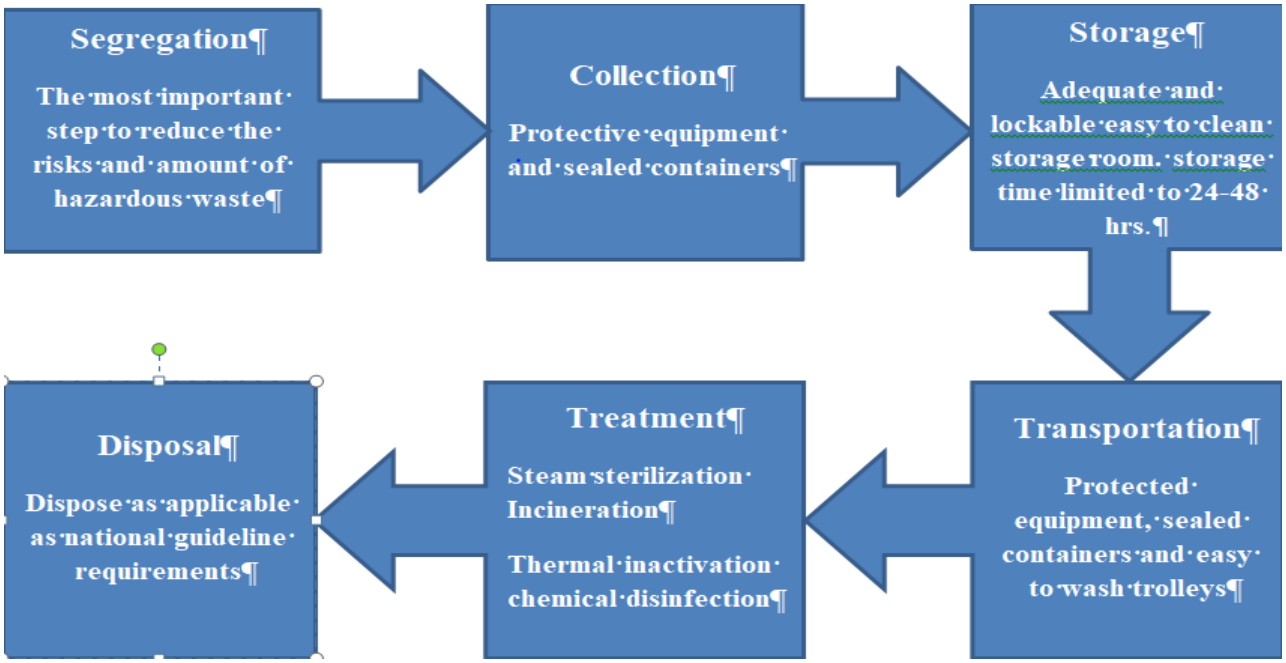

Figure 2: Biomedical Waste Management Stream Summarized

Source: National and InternationalGuidelines (FMoH, 2008; WHO, 2014).

Appropriate hospital waste management system is essential components of quality assurance in hospitals. But a larger proportion of HCPs are less aware about the proper management of biomedical waste. Ultimate aim of waste management is the prevention of disease and protection of environment (Joshi and Diwn, 2015). Although the solid waste management has become one of the major topics of importance but still local bodies are unable to give the proper attention towards some special sources of wastes out of which biomedical waste is one. Study in Ethiopia showed that management of the healthcare waste is doing by traditional way and some of the healthcare waste disposal to be in-forced by the good will of managers. And the other assumption is the limitation of existing facilities, lack of adequate institutional arrangements, operation in efficiency, and local authorities' inefficiency are some points for the poor management but few take proper care of their waste (Haile, Alemayehu and Abera, 2008).

Biomedical waste segregation and colour coding

There are a number of the common procedures followed at the hospitals in managing medical waste which include the following:

- Sharps should all be collected together, regardless of whether or not they are contaminated.
- Sharps containers should be puncture-proof and are usually made of metal or high-density plastics.
- Sharps containers should be tamperproof and fitted with covers that do not allow access to the sharps contained within.
- The containers should be rigid and impermeable so that they safely retain not only the sharps but also residual liquids from syringes.
- General waste like garbage, garden refuse etc. should join the stream of domestic refuse (Acharya and Singh, 2000), as cited in (Patience, 2013).
- Sharps should be collected in puncture-proof containers.
- Bags and containers for infectious waste should be marked with Biohazard symbol.

Figure 3: International infectious substance symbol
Source: Chartier et al, 2014

The key to minimization and effective management of medical waste is segregation (separation) and identification of the waste. (Rao, Ranyal, Sharm et al., 2004). They recommend that the most appropriate way of identifying the categories of medical waste is by sorting the waste into colour-coded plastic bags or containers. Medical waste should be segregated into containers/ bags at the point of generation.

Table 2.2: Categories of Wastes and Their Containers' Colour-Code

Category	Example of BMWs	Colour of the bin liner
Non-infectious	Paper, plastic bottles, food, cartons	**Black**
Infectious	Gloves, gauze, blood and body fluid contaminated materials, used specimen containers	**Yellow**
Highly infectious	Anatomical waste Pathological waste	**Red**
Chemical	Formaldehyde, pathologic chemicals, solvents, organic and inorganic chemicals	**Brown**
Radioactive	Any solid, liquid, or pathological waste contaminated with radio-active isotopes of any kind	**Yellow with radioactive label**

Source: Chartier et al, 2014

Each type of medical waste must be disposed in the correct container. Colour coding enables health care workers to dispose medical waste into the correct containers. It also provides a visual indication of the potential risk posed by the medical waste in that container. Medical waste bags and containers should be labelled with the date, type of waste and point of generation to allow easy tracking and is described in **Table 2.2**.

Biomedical waste final disposal methods

Highly infectious waste should be sterilized by autoclaving. Needles and syringes should be destroyed with the help of needle destroyer and syringe cutters provided at the point of generation. Infusion sets, bottles and gloves should be cut with curved scissors. Medical waste should be transported within the hospital by means of wheeled trolleys, containers or carts that are not used for any other purpose. The trolleys have to be cleaned daily. Biohazard symbol should be painted and suitable system for securing the load during transport should be ensured. Such a vehicle should be easily cleanable with rounded corners.

Final treatment of medical waste can be done by technologies like incineration, autoclave, hydro-clave or microwave. Some of the more common treatment and disposal methods utilized in the management of infectious healthcare wastes in developing countries are: autoclaves and retorts; microwave disinfection systems; chemical disinfections; combustions

(low-, medium-, and high-technology); and disposal on land (dump site, controlled landfill, pits and sanitary landfill) (Diaz, Savage, and Eggerth, 2005).

Legislative requirements and guidelines on disposal of medical waste

Some countries have legislation which regulates medical waste disposal and others do not. In Ethiopia, although there are no legislations found about biomedical wastes specifically, there are healthcare waste management directives developed by Ethiopian Food, Medicine and Healthcare Administration and Control Authority, EFMHCA, 2005 and National Policy Context in Ethiopia, 2016.

According to the National Policy Context in Ethiopia, study session 15, there is a proclamation that aims to prevent environmental damage from solid waste while harnessing its potential economic benefits. It defines solid waste management as the collection, transportation, storage, recycling or disposal of solid waste. The proclamation indicates the need for involvement of the private sector for effective management and describes the safe transport of solid waste including hazardous waste (FDRE, 2007).

2.3. Conceptual framework

The conceptual frame work of the study is extracted from review of theoretical and empirical studies. To establish a conceptual framework, this paper will look three main domains (Knowledge, Attitude and Practice) in relation to predictor variables (socio demographic and HCF related factors). Figure4illustrates relationships between socio demographic and HCF related factors with HCWs' knowledge, attitude and practice towards BMWM. Socio demographic factors may influence HCWs level of knowledge, attitude and practice for BMWM. Similarly, HCF related factors could also influence their level of knowledge, attitude and practice as well. Finally, health care workers' knowledge can in turn affect their level of practice on BMWM and level of attitude may have an impact on their practices as well.

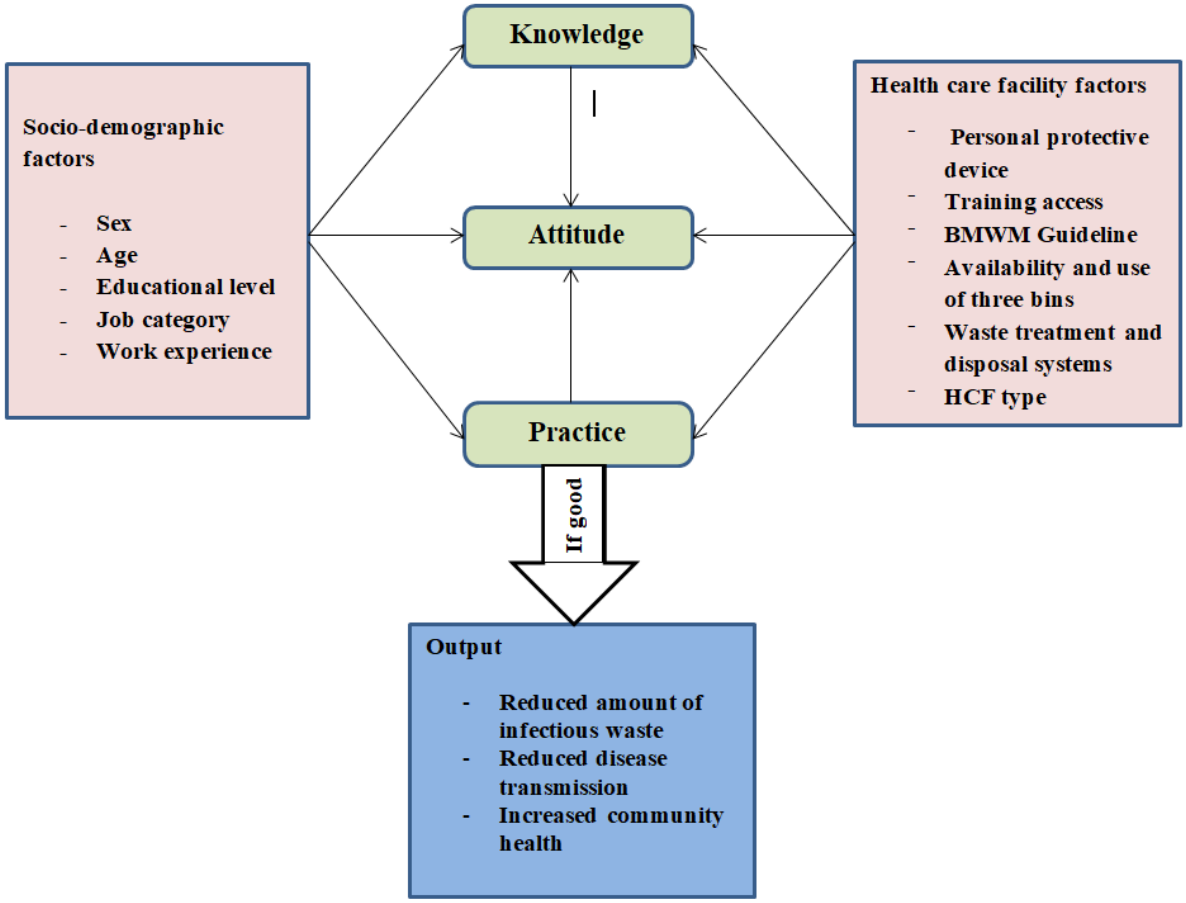

Figure4: A Conceptual Framework Showing the Relationship between dependent and independent variables

2.4. Priorities for empirical investigation on KAP of HCWS

Knowledge attitude and practice of health care workers with regard to disposal of medical waste plays a role in its improvement. Assessment of knowledge attitude and practice gaps should be made and addressed with required training. A study conducted among hospitals of Allahabad City in India on knowledge about medical waste revealed that doctors, nurses and laboratory technicians had better knowledge than general assistants regarding disposal of medical waste (Mathur, Dwivedi, Hassan &Misra, 2010). A study conducted in Gondar Town, North West Ethiopia in 2012, on medical waste disposal practices among health care workers indicated that the majority of health care workers had a low level of knowledge on the existence of manuals on medical waste, types of medical waste, colour coding of containers for waste and the importance of waste segregation (Yenesew, Moges, Woldeyohannes, 2012).

A cross sectional study conducted in 2015 among health care personnel at tertiary care hospital, in India showed that among 200 study participants, 52% were working in hospital from 1 to 5 years followed by <1 year 29%, 6-10 years 12.5% and >10 years 6.5%.

Knowledge score as satisfactory was highest among doctors (86%), followed by nursing staff (70%) and lab technicians (46%).

The practice score of BMWM was satisfactory in most doctors (90%), nursing staff (78%) and lab technician (68%) and it was poor in 62% of sanitary workers. On the other hand, attitude score as satisfactory was highest among doctors (100%) followed by nurses (74%) and lab technicians (64%) and attitude scores as poor were among sanitary workers (54%) (Gupta,Mohapatra and Kumar, 2015).

Radha conducted another cross-sectional study in India during 2012 and the result showed that doctors had better knowledge about BMWM compared to other categories except knowledge of disposal of sharps in blue colour puncture proof containers (31%) in which other categories had better knowledge. Only 16% of the sanitary staffs were aware of the diseases transmitted by BMW. The majority of sanitary staff felt that, management of BMW is not an issue at all and they felt that the safe management of BMW is an extra burden at work. The majority of nurses and lab technicians had favourable practices than other groups (Radha, 2012).

Further cross-sectional study was conducted in Nainital, India by Kumar *et al* 2015 and about 70.9% nurses, 45.8% sanitary staff, 33.3% lab technicians and 31.4 % doctors had correct knowledge on disposal of infectious wastes in a yellow colour bag. About 80.4% doctors, 65% nurses, 58.3% sanitary staff and 28.6% lab technician had known about disposal of BMW in blue/white container and 85.5% HCW were able to identify biohazards symbols. About 69.1% were immunized for hepatitis B. About 75% of the sanitary staff, 57.1% of lab technicians, 27.5% doctors and 11.7% nurses had not taken Hepatitis B vaccine. About 95% HCW used PPE while handling and disposal of BMW and 65.5% of HCWs (74.8% nurses, 78.8% sanitary staff, 54.9% doctors and 52.4% lab technicians) practiced segregation at source. In addition, 61.2% of nurses, 21.6% doctors and 9.5% lab technicians received training on BMW (Kumar, Singh and Umesh, 2015).

Ray and his colleaguesconducted a cross sectional study in Kolkata, India during 2014 to assess knowledge attitude and practices of BMWM. Among 140 study participants, a significant gap was observed on the knowledge of doctors with regard to biomedical waste disposal in addition to this attitude and practice of BMWM among doctors was 73.12% and 77.81%, respectively. Similarly, overall rates of satisfactory knowledge, attitude and practice among nursing staff were 98.21%, 98.21% and 97.32%, respectively.

Knowledge of BMWM, attitude and practices among labs were 56.26%, 53.90% and 53.73% respectively. Among sweepers the overall knowledge, attitude and practice about BMWM were 36.25%, 37.5% and of 37.50%, respectively (Ray, Ghosh, Hait et al., 2014).

A descriptive cross-sectional study was conducted in Iran during 2015. Among 130 study participants, 12%, 72% and 16% had low, medium and high knowledge, respectively towards hospital MW where as 16% and 84% had medium and high attitude towards hospital WM respectively. About 4%, 46% and 50% had low, medium and high practice respectively (Amouei, Fallah, Asgharnia et al., 2015).

Another descriptive cross-sectional study was done among nursing staff during 2014 in Bangladesh to assess their level of knowledge. Among 125 respondents, 18.4%, 26.4 %, and 55.2% had service less than 5 years, 5–10 greater than10 years, respectively. Among respondents, 61.6% were trained about hospital WM. Knowledge about general waste, infectious waste, biomedical waste and color-coded bins were 4%, 63.2% 7.2% and 46.4%, respectively whereas regarding knowledge about safe disposal of hospital waste 16% of them could not give any correct answer (Uddin, Islam and Yesmin, 2014).

A cross sectional study was conducted in Nigeria during 2015 and the result indicated that only 50.8% knew about colour coding while 37.2% heard about segregation and 45.0% had good knowledge about healthcare WM. Attitude of respondents was assessed using 3 point Likert scale and 83.8% of them felt health care WM was their concern, but 37.2% felt healthcare WM was the sole responsibility of cleaners. About 45.5% had positive attitude, while 54.5% had poor attitudes towards healthcare WM.

About 40.3% of the respondents practiced segregation of healthcare waste, 47.6% worked in centres with written policy on healthcare WM, 31.4% had been trained on healthcare WM, and open dumping was practiced by 35.6% followed by burning (23%) and burial (19.9%) (Sabiha, Tufail, and Sofia, 2015).

Another cross-sectional study in Nigeria in 2015 among 331 HCPs included, about 96.7% and 0.9% of them were tertiary and primary education, respectively. About 93% HCW were knowledgeable on the hazards of healthcare waste. Practice of discarding of sharps into the safety box was high (Azuike, Adinma, Nwabueze et al., 2015)

In Morocco further study was carried out during 2015. Among 219 healthcare personnel and their assistants studied, housekeepers demonstrated higher knowledge on waste separation

(49.4%) followed by nurses (45.7%), and doctors (38.6%). Practices of WM in most surveyed hospitals did not comply with the principles stated in Moroccan legislation (Marki and Dnane, 2014).

A cross-sectional study was conducted during 2014. Among 350 health-care personnel studied, 67.5% nurses, 38.2% physicians and 21.3% housekeepers received training on WM. About 93.3% housekeeping staff knew existence of hospital and department plans for waste disposal. Physician's correct knowledge on the use of sharp boxes (51.8%) and identification of biohazard symbol (47.3%) was higher than nurses and housekeepers. About 68.3%, 60.9% and 40.4% of physicians, nurses and housekeepers had satisfactory knowledge scores respectively. On the other hand, 84.0% nurses had satisfactory practice scores than physicians (67.3%). Housekeepers also had the highest overall scores for attitudes towards waste disposal (Hakim and Mohsen, 2014).

A study was conducted at Adama city health care facilities in Ethiopia during 2014 to assess health care waste generation rate and its management. Five HCFs were studied and the result indicated that most (75%) HCPs have knowledge of different categories of health care wastes, but only 37% knew colour-coding system used for waste containers and 28% of HCPs knew the existence of HCWM guidelines. In addition, only 31% of HCPs had received training on safe HCWM practices. There was no segregation of healthcare waste by type at the point of generation. The use of a colour coding system for HCW containers was not practiced and there was no labelling practice for hazardous waste. Furthermore, there was a low level of awareness about safe healthcare WM. Health care waste was temporarily stored in plastic buckets. In addition to this, there was no practice of pre-treatment of infectious wastes in the studied HCFs. Open pit burning and single chamber incinerators were the most utilized final treatment methods (Hayleyesus and chernet, 2016).

A study conducted at Debre-Birhan hospital indicated that segregation of health care wastes by type was not practiced. In addition, the study was more of descriptive it did not indicate proportions of HCWs' knowledge, attitude and practice score. This study was mainly focused on health care waste generation rate rather than assessment of knowledge, attitude and practices of health care professionals (Esubalew, 2007).

A study was conducted in Hawassa city on assessment of health care WM at a facility level. The result indicated that most HCFs did not practiced segregation of waste at their facility and only one HCF was used complete colour coding system (yellow, black and safety box).

However, even in that facility general waste was often mixed with infectious waste. In addition, most HCFs did not use safety boxes. Waste was transported mostly in open plastic containers from generation site to the treatment area and in most HCFs waste was collected from generation areas twice a day. As a treatment method, most HCFs use low combustion, single chamber, and brick incinerators. None of the HCFs reported employing other waste treatment options such as autoclaving, steam sterilization, microwave irradiation or chemical disinfection. Most of them were exercised open dumping of incinerated ash; moreover, waste handlers experienced needle-stick injuries at least once in their life ranged from 25-100%. Moreover, all HCFs reported that they had never given any immunization/vaccination to their waste handlers (Haylemicheal,Dalvie, Yirsaw et al., 2011).

Summary

Literature on knowledge and practice of health care workers on medical waste disposal has been reviewed to provide insight to this study. The literature review has revealed that most hospitals are facing challenges with regard to medical waste disposal.

Improper practices on medical waste disposal includes mixing of different types of waste, improper disposal of sharps and the colour coding of waste disposal containers not followed. In some institutions, the lack of knowledge on WM among healthcare workers leads to poor MW disposal. There is also non-compliance to waste disposal policies and guidelines in some institutions. The literature review has provided the researcher with information regarding the different methodologies used to research the topic. The next chapter outlines the research methodology used in this research.

CHAPTER THREE

3. RESEARCH METHOD AND DESIGN

3.1. Description of the Study Area

According to the list obtained by Federal Minstry of Health, there are 11 private and 25 public hosptals that are found in Addis Ababa (Nair et al., 2011). Out of these, the study has selected one public Hospital (Zewditu) and one private Hospital (MCM). The healthcare facilities were selected from a point of view of that they are comparable in their level and service areas,both areGeneral Hospitals and have different departments such as, Out-Patient Departments (OPDs), in-patient wards (gynaecological and obstetric, surgical, medical, paediatric, eye and kidney units). According to Zewditu Memorial Hospital human resource department report, during 2019/20 there are 50 General Practitioners (GP) and 30 specialists, 7 Dentists, a total of 87 doctors, 13 Health Officers (HO), 16 anaesthetists, 287 professional nurses, 35 clinical nurses, 56 midwifes, 4 psychiatry nurses, 2 optometry nurses , a total of 384 nurses, 46 medical laboratory technicians. In addition to this, the hospital management has outsourced waste cleaners to a private business and 92 cleaners are currently working as a fulltime employee. Hence, total number of HCWs and cleaners is 638. Likewise, the human resource department of MCM General Hospital, during 2019/20 there are 28 GP and 33 specialists, 15 Dentists, a total of 76 Doctors, 7 anaesthetists, 186 professional Nurses, 15 midwifes, a total of 201 nurses, 16 laboratory technicians, and 65 cleaners. Therefore, total number of HCWs and cleaners is 365.

3.2. Rationale for Empirical Research

Improper management of waste generated in health care facilities causes a direct health hazards on the society, the health care workers and on the environment. There is a requirement for the management of biomedical waste to minimize the risk of infection outside the hospital for waste handlers, scavengers and those living in the vicinity of hospitals. Management is also needed due to the risk of environmental pollution (Aggrarwal and Kumar,2015). Biomedical waste management is of great significance because biomedical waste can adversely affect health inviting serious implications to the people who get in touch with it. Segregation, storage and safe disposal of the waste is the key to the effective management of biomedical waste in a workplace (Shrestha et al., 2017 and Bhagawati et al., 2015), which is primarily the responsibility of health care workers. In order to assure proper BMWM it is mandatory to work on the gaps of health workers on theirknowledge, attitude

and practice of health works. This paper is initiated to contribute to the limited studies that are found in this area by determining the KAP of healthcare workers and the associated factors with KAP.

3.3. Research Design, Strategy and Approach

Cross-sectional study design was used for the reason that the study participants are selected on a particular variable of interest. Descriptive statistics as well as inferential statistics, followed by multiple linear regression analysis was used to draw final concussions. The study used mixed approach, both qualitative and quantitative approach.

3.3.1. Population, Selection of Participants Sampling

3.3.1.1. Target population

The population size considered was 1003 where 638 of them were from Zewditu and 365 were from MCM hospital.

3.3.1.2. Sampling technique and sample size determination

Stratified random sampling followed by proportional allocation to size was applied to select the samples. According to Cochran (1977), stratified random sampling technique is used when the population is divided into non-overlapping but in-depth groups called strata. It is applied if the population is heterogeneous and the elements in the same strata should be more or less homogeneous while different in different strata. At the end step of this method, simple random sampling technique is applied to select the sampling units from each stratum. The formula to calculate the sample size when using stratified random sampling technique is as follows:

$$n = \frac{\sum_{i=1}^{L}\left(\frac{N_i^2 p_i q_i}{w_i}\right)}{\frac{N^2 d^2}{Z^2} + \sum_{i=1}^{L}(N_i p_i q_i)}$$

where:

- n is the sample size needed,
- L is the total number of strata,
- d is the margin of error
- N is the total population size in the study
- N_i is the size of stratum(i)
- w_i is the estimated proportion of N_i to N
- p_i is the subpopulation proportion for stratum(i),
- Z is the inverse of the standard normal cumulative distribution that corresponds to the level of confidence. It's values that correspond to the 5% confidence level ($\alpha = 0.05$) is 1.96

The population is divided into two strata based on the nature of the hospitals. Stratum 1 is Zewditu hospital (government) and stratum 2 is MCM hospital (private), where N1 = 638 represents for Zewditu population size and N2 = 365 represents for MCM population size in whichN = 1003. Hence, the values of w1 and w2 are as follows:

w1 = N1/N = 0.636092; w2 = N2/N = 0.363908

In this study, p_i is the subpopulation proportion for stratum (i): where p1 = p2 = p = 0.75, which is found from previous study by Hayleyesus and chernet (2016). Hence, q = 0.25. The confidence level of 95% and a margin of error of 0.05 were considered. The sample size n is calculated as:

$$n = \frac{\frac{(638)^2 \times 0.75 \times 0.25}{0.636092} + \frac{(365)^2 \times 0.75 \times 0.25}{0.363908}}{\frac{(1003)^2(0.05)^2}{(1.96)^2} + (638 \times 0.75 \times 0.25 + 365 \times 0.75 \times 0.25)}$$

$$n = \frac{19{,}983.823 + 68{,}642.864}{654.681 + (119.625 + 68.438)}$$

$$n = \frac{188{,}626.687}{842.744} = 223.824 \approx 224$$

$$n \approx 224$$

The non-response rate, which is 10% of the calculated sample size ($10\%n$), adjustment should always be applied regardless of what sampling design will be used or what statistical analysis is planned. The sample size required is the number of valid responses not the number of subjects selected to participate in the study. Hence, it is calculated as:

$$10\%n = \frac{10 \times 224}{100} = 22.4 \approx 22$$

Finally, the sample size is:

$$n = 224 + 22 = 246$$

Now, we need to calculate the sample size needed for each of the population groups (strata): Zewditu and MCM by using proportional allocation to size method, which is given as:

$$\frac{N_i}{N} \times n$$

For Zewditu $n_1 = \frac{638}{1003} \times 246 = 156.479 \approx 156$

For MCM $n_2 = \frac{365}{1003} \times 246 = 89.521 \approx 90$

Similarly, the proportional allocation to size for each sub-group of each group was also calculated. The sub-groups are: (1) Zewdituhealthcare professionals (N11=546) and Zewditu cleaners (N12=92); and (2) MCM healthcare professionals (N21=300) and MCM cleaners (N22=65). The summary of sample size is displayed inTable 3.1.

Table 3.1: **Summary of sample sizes**

No.	Hospital Name		Population size of each Hospital	Sample size for each sub-group (n_{ij})
1	Zewditu	healthcare professionals	$N_{11} = 546$	$n_{11} = 133.505 \approx 134$
		Cleaners	$N_{12} = 92$	$n_{12} = 22.495 \approx 22$
		Sub-total	$\boldsymbol{N_1 = 638}$	$\boldsymbol{n_1 = 156}$
2	MCM	healthcare professionals	$N_{21} = 300$	$n_{21} = 73.973 \approx 74$
		Cleaners	$N_{22} = 65$	$n_{22} = 16.027 \approx 16$
		Sub-total	$\boldsymbol{N_2 = 365}$	$\boldsymbol{n_2 = 90}$
Total			$\boldsymbol{N = 1{,}003}$	$\boldsymbol{n = 246}$

3.3.2. Data Collection

Primary data was collected using structured self-administered questionnaire consisting of (44) questions and observational checklists. The questionnaire and observational checklists were developed based on the recommendations of the World Health Organization for evaluation of hospital WM in developing countries (Pru ¨ss, Giroult, and Rushbrook, 1999; WHO, 1999).

After obtaining an informed consent, questionnaires were distributed as hard copies for HCPs. The data collectors read the questionnaire for cleaners as they may have difficulties in reading or understanding especially medical terms used in the questionnaire. During the data collection time, data collectors checked for completeness of the questionnaires. Then, the incomplete questionnaires were given back again to the participants immediately for completness.

Inclusion Criteria for data collection

- All HCPs (doctors, labs, nurses, HOs and midwives) and cleaners in the studying HCFs with at least one year of experience.
- Only permanent employee in that specific facility will be included
- Participants who only consent to take part in the study will be included

3.3.3. Variables in the Study

Dependent Variables

- Knowledge
- Attitude
- Practice

Independent Variables

- **Socio demographic factors**
  - Sex
  - Age
  - Educational level
  - Stream of education
  - Work experience
- **Health care facility related factors**
  - Personal protective equipment
  - Previous training access on BMWM
  - BMWM guideline/ operational document
  - Availability and use of all three bins
  - Waste treatment and disposal systems
  - HCF type

3.3.4. Data Analysis

Descriptive and inferential statistics methods were used to analyse the data. In the descriptive statistics methods, mean, median, percentage, and frequency tables were applied. In the inferential statistics case, Pearson's correlation, and Chi-squared test were used to assess associations between the dependent and independent variables. Multiple linear regression analysis was used to identify the major predictor variables having significant association with the outcome variables. Finally, qualitative findings from the hospital observational checklists were paraphrased.

Multiple linear regression model description

Assume thatthe data is collected on continuous dependent variable with m explanatory variables. Let y denotes the dependent variable that is linearly related to k independent variables $X_1, X_2, \dots, X_k$ through the parameters$\beta_1, \beta_2, \dots, \beta_k$. Hence y can be written as:

$$y = \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_{ki} + e_i$$

Where:

- $y_i$is the value of the i^{th} case of the dependent scale variable
- k is the number of predictors
- $\beta_i$is the value of the i^{th} coefficient, i=0..., k
- $X_{ij}$is the value of the i^{th} case of the j^{th} predictor
- $e_i$is the error in the observed value for the i^{th} case

In this model, the parameters, $\beta_1, \beta_2, \dots, \beta_k$, are the regression coefficients associated with the independent variables $X_1, X_2, \dots, X_k$, respectively. The term e_i is the error component,

which is the result of the differences of the observed outcome and the fitted outcome. This is given as follows:

$$[y - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k)] = e_i$$

In fitting a regression equation, the error component has to be closer to zero. That means, the j^{th} regression coefficient β_i represents the expected change in $y$per unit change in i^{th} independent variable X when $E(e_i) = 0$. Therefore,

$$\beta_i = \frac{\partial E(y)}{\partial X_i}$$

A model is said to be linear when it is linear in parameters.

Assumptions of Linear regression analysis

Some of the assumptions in multiple linear regressions are:

(1). For each value of the independent variable, the distribution of the dependent variable must be normal.

(2). The variance of the distribution of the dependent variable should be constant for all values of the independent variable (i.e., $E(e) = 0$).

(3). The relationship between the dependent variable and each independent variable should be linear

(4). All observations should be independent (there must not be Multicolinearity problem)

Estimation of parameters

Estimation of regression coefficient vector is to minimize the expression

$$\sum M(e_i) = \sum M(y - \beta_1 X_1 - \beta_2 X_2 - \cdots - \beta_k X_k); \quad for\ a\ suitably\ chosen\ function\ M$$

There are different techniques that minimize the sum of square error component in order to estimate the parameters. The common one is using ordinary least square (OLS) method. The OLS minimizes the expression of the sum of squares. That means,

$$Minimize(SSE) = Minimize(e^2) = Minimize \sum [y - \beta_1 X_1 - \beta_2 X_2 - \cdots - \beta_k X_k]^2$$

Let B be the set of all possible vectors ofβ. If there is no further information, then, B is k - dimensional real Euclidean space. The aim is to find a vector $b' = (b_1, b_2, \ldots, b_k)$from B that minimizes the sum of squared deviations of $e_i's$.

$$S(\beta) = \sum e_i^2 = e'e = \sum [y - \beta_1 X_1 - \beta_2 X_2 - \cdots - \beta_k X_k]^2$$

$$S(\beta) = \sum (y - X\beta)'(y - X\beta) \; for given \; y \; and \; X.$$

A minimum value always exists as $s(\beta)$ is a real valued, convex and differentiable function. Therefore, it is expressed as:

$$S(\beta) = y'y + \beta' X' X\beta - 2\beta' X' y$$

Differentiate $S(\beta)$ with respect to β and equate it to zero. That means,

$$\frac{\partial S(\beta)}{\partial \beta} = 2X'X\beta - 2X'y$$

$$\frac{\partial(\partial S(\beta))}{\partial(\partial \beta)} = \frac{\partial^2 S(\beta)}{\partial^2 \beta} = 2X'X$$

Hence, the normal equation is:

$$\frac{\partial S(\beta)}{\partial \beta} = 2X'X\beta - 2X'y = 0$$

$$=> \; 2X'X\beta = 2X'y$$

$$\beta = (X'X)^{-1}X'y$$

Since it is assumed that rank(X) = k (full rank), then X'X is positive definite and unique solution of normal equation is:

$$b = (X'X)^{-1}X'y$$

This is termed as ordinary least squares estimator (OLSE) of β.

Model Adequacy checking

There are several ways, which are used to check the adequacy of the model. Analysis of variance is one of the adequacies checking methods, which is used to test the overall or global adequacy of model. The null and alternative hypothesis is:

$$H_0: \quad \beta_2 = \qquad \beta_3 = \quad \ldots \quad \beta_k = 0$$

$$H_1: \quad \beta_i = \quad \neq \quad 0 \quad for \; at \; least \; one \; \; i = 2, 3, \ldots, k$$

This hypothesis determines if there is a linear relationship between y and any set of the explanatory variables $X_2, \; X_3, \ldots, X_k$. $X_1$is the intercept term in the model and hence $x_{i1} = 1$ for all $i = 1, 2, \ldots, n$. Rejection of the null hypothesis indicates that at least one of the explanatory variables among $X_2, \; X_3, \ldots, X_k$ contributes significantly to the model.

3.3.5. Methods of Measurement (Scoring)

The score for KAP were transformed into percentage scores by dividing the scores obtained by the respondents with the possible maximum scores and multiplied by 100. The sum score of each outcome was assessed based on Bloom's cut off point (Bloom, 1956). Based on the sum scores, level of knowledge was calsssified in to inadequate level (less than 60%; 2-5 scores), moderate level (60-80%; 6-7 scores) and adequate level (80-100%; 8-11 scores). Meanwhile, the scores were classified into positive attitude (80-100%; 15-18 scores), neutral (60-80%; 10-14) and negative attitude (less than 60%; 0-9 scores). Successively, level of practice was classified into good level (80-100%; 6-8 scores), fair level (60-80%; 4-5 scores) and poor level (less than 60%; 1-3 scores) which all are displayed inTable 3.2.

Table 3.2: Bloom's cut off points for Knowledge, Attitude, and Practice

No.	Bloom's cut off point	Dependent Variables		
		Knowledge	Attitude	Practice
1.	80%-100%	Adequate level	Positive	Good practice
2.	60%-79%	Moderate level	Neutral	Fair practice
3.	less than 59%	Inadequate levels	Negative	Poor practice

3.3.6. Measures for Trustworthiness (Validity and Reliability)

3.3.6.1. Content Validity

The Questionnaires and observational checklists werefirstdeveloped by the principal investigator. Then, they have been validated through discussion with experts, advisors, and from review of available scientific literatures (Sabageh, Adeomi, Adediran et al., 2015; Hakim, Mohsen, and Bakr 2014). Both national and international guidelines were also revised to complement the study population (Chartier, Emmanuel, Pieper et al, 2014). They were first prepared in English and were translated into Amharic and back to English to ensure correctness of translation.

Measures for the reliability of bias

Questionnaires and observational checklists were structured in a way that there is no inter data collector variability. The study avoided participant selection bias by addressing the appropriate sampling techniques and by giving training for data collectors on how to approach study participants and on spot-checking during data collection. To maintain quality data entry, data were entered into SPSS Version 23 software due to its stringent nature to maintain quality data entry.

3.3.6.2. Internal Consistency Reliability

Internal consistency was analysed using Chronbach's Alpha coefficient. A general accepted rule is that Chronbach's Alpha coefficient of 0.6-0.7 indicates an acceptable level of reliability, and 0.8 or greater a very good level (Hulin, Netemeyer, and Cudeck, 2001). The overall Chronbach's Alpha value is 0.688, which indicated that the scale items are reliable.

3.3.7. Ethical Considerations

Ethical approval was obtained from Addis Ababa public health research and emergency management directorate. Otherpermissions for carrying out the study were obtained from both hospitals. Administration/Medical Directors and study participants have been informed about the purpose of the study. Confidentiality was maintained at all levels of the study. Participants' involvement was on voluntary basis. Participants who were unwilling to participate and those who wish to quit their participation at any stage were informed to do so without any restrictions.

Summary

This chapter focused on the research methodology used for the study of knowledge and practices of health care workers on disposal of BMW. Sampling, inclusion and exclusion criteria were described. The procedure used to collect data was explained. Data analysis methods used were outlined. Measures to ensure validity and reliability were described. Ethical considerations were also described. The next chapter deals with data analysis.

CHAPTER FOUR

4. DATA ANALYSIS AND INTERPRETATION

4.1. Introduction

The aim of the study was to determine the KAP of healthcare workers about biomedical waste management at Zewditu and MCM hospital. The study used both qualitative and quantitative research approach. Both descriptive and inferential data analyses methods, particularly, multiple linear regression analysis were used.

Then the questionnaire was distributed to 246 participants. However, there were 3 non-respondents and so the data analyses were employed out from 243 respondents in which (153) was Zewditu hospital HCPs and (90) were MCM hospital HCPs. A correlation analysis was carried out to establish the relationship between variables. This has been then followed by a linear regression analysis.

4.2. Qualitative Data analysis

Table 4.1:Summary of observation of Health care facility MMWM management system

			Hospital type	
No	**Variable**	**Category**	**Zewditu**	**MCM**
1.	BMW storage method	Onsite storage	-	✓
		Puncture resistant storage containers	✓	✓
2.	BMW stored more than 24 hrs.	No	-	✓
		Yes	✓	-
3.	Is there onsite BMW treatment	No	✓	✓
		Yes	-	-
4.	BMW disposal system	Incineration	✓	✓
		Sterilization	-	✓
		Chemical	✓	✓
		Burning	✓	✓
		Others	-	-

As it is indicated inTable 4.1onsite BMW storage method is only available at MCM hospital which helps the on time collection of wastes and both hospitals uses puncture resistant storage containers for prevention of needle- stick injuries. At the time of healthcare facility observation, BMW which were stored more than 24 hrs. have seen at Zewditu memorial hospital only. Onsite BMW treatment was not available in both hospitals. Finally, it was

observed that BMW disposal system of Zewditu hospital is incineration, chemical treatment and burning. In addition to these three methods, MCM hospital uses the modern sterilization method of BMW disposal.

4.3. Quantitative data analysis

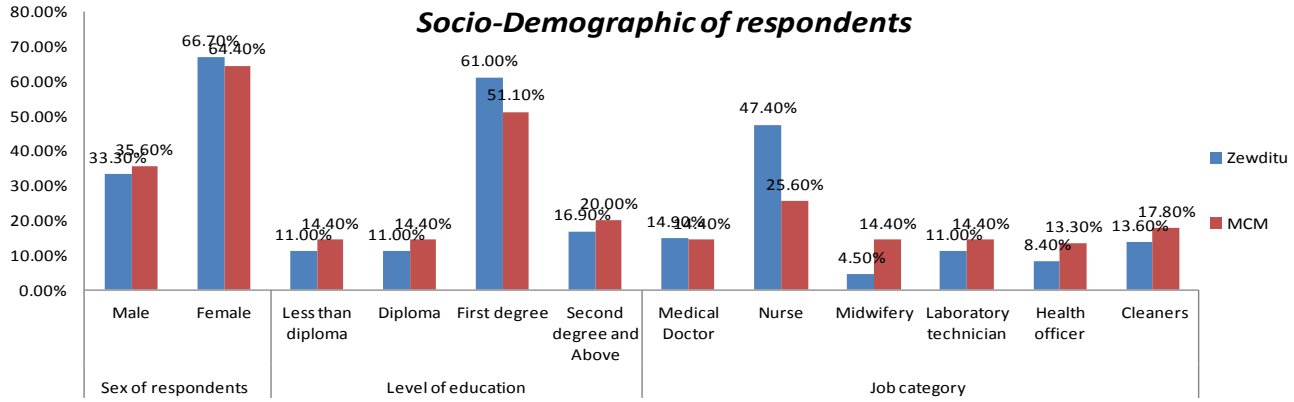

Figure 5: Socio-Demographic distribution of respondents

Figure 5shows the summary of respondents according to professional category, sex, level of education, and job category. A total of 133 (86.4%) and 74(82.2%), 21 (13.6%) and 16(17.8%) were health professionals and cleaners from Zewditu and MCM respectively. The percentage of male from Zewditu51(33.3%) was much less thanfemales 102(66.7%). Female participants 58(64.4%) and male 32(35.6%) were from MCM hospital. Majority of the health professionals 94 (61.0%) in zewditu hospital were first degree holders whereas 46(51.1%) health participants in MCM have got first degree. In both hospitals majority of participants were nurses; 73(47.4%) and 23(25.6%), in Zewditu and MCM hospitals respectively.

Table 4.2: Summary of age and work experience of respondents

Variable	Hospital type									
	Zewditu					MCM				
	N	Min	Max	Mean	St.Dev.	N	Min	Max	Mean	St.Dev.
Age of the respondents	154	21	60	34	9	90	22	55	33	8
Work experience	154	0	35	10	8	90	1	26	7	5

Table 4.2 indicated the average age of the respondents was (34) in Zewditu and (33) in MCM, and in both hospitals very young to well experienced adult professionals were participated which may contribute to obtain the data from different groups.Meanwhile, their work experience varies from new once to 35 yrs. in Zewditu and 1yr to 26 yrs. in MCM. And

the average work experience is 10 in Zewditu and 7 in MCM. Their experience will help to know their knowledge, attitude and knowledge about BMWM.

4.4. Bivariate analysis result

4.4.1. Knowledge and Socio-Demographic Factors

All variables that measure knowledge are greater than the required P Value of 0.05. This implies that sex of respondents does not have association with knowledge (**Annex 1Table 1**).

Table 4.3: Knowledge and Healthcare facilities related factors

	Chi-Square Tests		**Hospital type**	
No	**Educational level**		**Zewditu**	**MCM**
1.	knowing about colour coding segregation of biomedical wastes	Chi-square	14.401	.995
		Df	3	3
		Sig.	.002**	.802
2.	Do you know biohazard symbol	Chi-square	15.248	.256
		Df	3	3
		Sig.	.002**	.968[a]
3.	Do you know type of BMW to be disposed in yellow bin	Chi-square	13.914	15.020
		Df	3	3
		Sig.	.003**	.002*
4.	Do you know how maximum full should be a safety box	Chi-square	9.304	.849
		Df	3	3
		Sig.	.026**	.838
	Job category		**Zewditu**	**MCM**
1	knowing about biomedical waste management	Chi-square	7.994	15.441
		Df	5	5
		Sig.	.157	.009*
2	Do you know biohazard symbol	Chi-square	17.079	4.071
		Df	5	5
		Sig.	.004*	.539
3	Do you know type of BMW to be disposed in yellow bin	Chi-square	10.200	16.130
		Df	5	5
		Sig.	.070	.006**
4	Do you know type of BMW to be disposed in black bin	Chi-square	9.314	13.118
		Df	5	5
		Sig.	.097	.022*
	Trainig		**Zewditu**	**MCM**
1	knowing about biomedical waste management	Chi-square	7.240	6.851
		Df	1	1
		Sig.	.007**	.009**
2	Health hazard associated with biomedical wastes	Chi-square	4.120	.
		Df	1	.
3	Wearing personal protective equipment reduce risk of infection	Chi-square	2.194	.
		Df	1	.
		Sig.	.139[b]	.
4.	knowing about colour coding segregation of biomedical wastes	Chi-square	9.216	21.659
		Df	1	1
		Sig.	.002**	.000***

Table 4.3: Continues ...

No	Chi-Square Tests Presence of guideline		Hospital type Zewditu	 MCM
1.	knowing about biomedical waste management	Chi-square	6.185	15.310
		Df	2	2
		Sig.	.045*	.000***
2.	knowing about colour coding segregation of biomedical wastes	Chi-square	11.263	19.189
		Df	2	2
		Sig.	.004*	.000***
3.	Should infectiously waste containers be labelled with biohazard symbol?	Chi-square	.144	.
		Df	2	.
		Sig.	.931	.

*Note: Asterisks indicate level of significance where= *= signiciant at P≤0.05; ** at P≤0.01 and *** at P≤0.001.*

Results of Chi-square tests showed that knowledge is significantly associated with level of education and professional category of healthcare workers, previous training and the presence of guidelineon BMWM (Table 4.3).

Table 4.4: knowledge with Age and Work experience

No	Pearson's Correlation		Age	Exp erience
1.	knowing about biomedical waste management	Correlation Coefficient	1.000	.739**
		Sig. (2-tailed)	.	.000
		N	231	229
2.	Health hazard associated with biomedical wastes	Correlation Coefficient	.739**	1.000
		Sig. (2-tailed)	.000	.
		N	229	241
3.	Wearing personal protective equipment reduce risk of infection	Correlation Coefficient	.110*	.111*
		Sig. (2-tailed)	.045	.041
		N	231	241
4.	Should biomedical wastes be segregated into different categories at the point of generation?	Correlation Coefficient	.166**	.219**
		Sig. (2-tailed)	.003	.000
		N	231	241
5.	Do you know type of BMW to be disposed in black bin	Correlation Coefficient	-.144**	-.100
		Sig. (2-tailed)	.009	.065
		N	231	241

*Note: Asterisks indicate level of significance where= *= signiciant at P≤0.05; ** at P≤0.01 and *** at P≤0.001.on* BMWM (Table 4.3).

Table 4.4shows the results of Chi-square test. P= 0.000, 0.045, 0.003, 0.009 and 0.000, 0.041 are less than the required P value of 0.05, that indicates age and work experience are associated with the knowledge of HCPs.

4.4.2. Attitude and Socio-Demographic Factors

Table 4.5: Attitude and Heathcare facilities factors

No.	Chi-Square Tests			
			Hospital type	
	Educational level		**Zewditu**	**MCM**
1	Hepatitis B virus may be transmitted through biomedical wastes	Chi-square	15.880	31.430
		Df	12	9
		Sig.	.197	.000***
2	Hepatitis C virus may be transmitted through biomedical wastes	Chi-square	10.829	40.513
		Df	12	9
		Sig.	.544	.000*
3	Biomedical wastes do not transmit any infectious diseases	Chi-square	25.404	15.008
		Df	12	9
		Sig.	.013*	.091
	Presence of guidline		**Zewditu**	**MCM**
1.	Improperly managed health care wastes may cause infection	Chi-square	16.663	3.000
		Df	8	2
		Sig.	.034*	.223
2.	HIV may be transmitted through biomedical wastes	Chi-square	21.745	5.209
		Df	8	4
		Sig.	.005**	.267

*Note: Asterisks indicate level of significance where= *= signiciant at P≤0.05; ** at P≤0.01 and *** at P≤0.001.*

Attitude was highly significantly (P<0.001) associated with educational level for MCM hospital in two of the variables used to test attitude. But it was not significant for Zewditu for most of the variables that measured attitude. On the other hand, attitude was significantly associated with the presence of guideline for Zewditu Hospital while it was not significant for MCM (Table 4.5).

Table 4.6: Attitude with Age and work experience

No.	**Pearson's Correlation**		Age	Experience
1.	Hepatitis B virus may be transmitted through biomedical wastes	Correlation Coefficient	.097	.143*
		Sig. (2-tailed)	.140	.027
		N	231	240
2.	Hepatitis C virus may be transmitted through biomedical wastes	Correlation Coefficient	.102	.148*
		Sig. (2-tailed)	.122	.022
		N	229	239

*Note: Asterisks indicate level of significance where= *= signiciant at P≤0.05; ** at P≤0.01 and *** at P≤0.001.*

Attitude was highly significantly (P<0.001) associated with educational level for MCM hospital in two of the variables used to test attitude. But it was not significant for Zewditu for most of the variables that measured attitude. On the other hand, attitude was significantly associated with the presence of guideline for Zewditu Hospital while it was not significant for MCM (Table 4.5).

Table 4.6 indicated that attitude variables are significantly correlated with work experience. On the other hand, there was no significant correlation between attitude variables and respondents age.

4.4.3. Practice and Socio-Demographic Factors

Table 4.7: practiceand Healthcare related factors

	Chi-Square Tests		**Hospital type**	
No	**Sex of respondents**		**Zewditu**	**MCM**
1.	Do you label BMW container?	Chi-square	5.774	.832
		Df	1	1
		Sig.	.016*	.362
2.	Do you put non-infectious wastes in black bin?	Chi-square	.129	.878
		Df	1	1
		Sig.	.720	.349
	Educational level		**Zewditu**	**MCM**
1.	Do you label BMW container?	Chi-square	8.666	14.675
		Df	3	3
		Sig.	.034*	.002*
No	**Job category**		**Zewditu**	**MCM**
1.	Do you label BMW container?	Chi-square	7.750	31.340
		Df	5	5
		Sig.	.171	.000*
2.	Do you segregate BMW at generation?	Chi-square	10.767	23.313
		Df	5	5
		Sig.	.056	.000***
3.	Do you wear gown while you are handling BMWs?	Chi-square	2.145	.
		Df	5	.
		Sig.	.829	.
	Training		**Zewditu**	**MCM**
1	Do you label BMW container?	Chi-square	10.307	8.439
		Df	1	1
		Sig.	.001***	.004**
	Presence of guidline		**Zewditu**	**MCM**
1	Do you label BMW container?	Chi-square	27.635	17.117
		Df	2	2
		Sig.	.000***	.000***
2	Do you follow colour coding segregation?	Chi-square	7.009	2.533
		Df	2	2
		Sig.	.030*	.282
3	Do you put sharp wastes in safety box?	Chi-square	6.180	1.666
		Df	2	2
		Sig.	.045*	.435

*Note: Asterisks indicate level of significance where= *= signiciant at P≤0.05; ** at P≤0.01 and *** at P≤0.001*

In spite of their sex, majority of respondents said they practice BMWM activities in both hospitals. Similarly, majority of respondents, regardless of their education level, said they segregate biomedical wastes according to their type and dispose them in their respective bins in both hospitals except forrespondents with<diploma in MCM. In addition, BMWM practice was significantly (P≤0.05) associated with job category of respondents for MCM hospital. There was no significant association for Zewditu hospital. Similar to the educational level, having training of BMWM significantly associated with one variable (labelling BMW container) that measured practice. Other variables weren't significantly associated. The presence of guideline significantly (P≤0.05) associated with respondent BMWM practice in Zewditu hospital. Except for one variable (labelling of BMW container) that measured practice, all other practice variables were not significantly associated with presence of guideline (Table 4.7).

Table 4.8: practice with Age and work experience

	Pearson's Correlation			
No			Age	Experience
1.	Do you label BMW container?	Correlation Coefficient	.156*	.187**
		Sig. (2-tailed)	.017	.004
		N	231	241
2.	Do you put infectious wastes in yellow bin?	Correlation Coefficient	.012	.101
		Sig. (2-tailed)	.852	.118
		N	231	241

*Note: Asterisks indicate level of significance where= *= signiciant at P≤0.05; ** at P≤0.01 and *** at P≤0.001.*

In spite of their sex, majority of respondents said they practice BMWM activities in both hospitals. Similarly, majority of respondents, regardless of their education level, said they segregate biomedical wastes according to their type and dispose them in their respective bins in both hospitals except forrespondents with<diploma in MCM. In addition, BMWM practice was significantly (P≤0.05) associated with job category of respondents for MCM hospital. There was no significant association for Zewditu hospital. Similar to the educational level, having training of BMWM significantly associated with one variable (labelling BMW container) that measured practice. Other variables weren't significantly associated. The presence of guideline significantly (P≤0.05) associated with respondent BMWM practice in Zewditu hospital. Except for one variable (labelling of BMW container) that measured practice, all other practice variables were not significantly associated with presence of guideline (Table 4.7).

Table 4.8 shows among the variables that measure practice of BMWM, labelling of BMW containers were significantly correlated with age and work experience of respondents.

Table 4.9: Association of practice and healthcare facility

No.	Healthcare facility factors		Practice
1.	Availability of visual aid/ instruction near the waste receptacles	Pearson Correlation	.245**
		Sig. (2-tailed)	.001
		N	172
2.	Availability of sufficient gloves in the department	Pearson Correlation	.262**
		Sig. (2-tailed)	.000
		N	173
3.	Availability of all 3 bins (black bin, yellow bin and safety box) in your department/ section	Pearson Correlation	.186**
		Sig. (2-tailed)	.010
		N	192

*Note: Asterisks indicate level of significance where= *= signiciant at P≤0.05; ** at P≤0.01 and *** at P≤0.001.*

From In spite of their sex, majority of respondents said they practice BMWM activities in both hospitals. Similarly, majority of respondents, regardless of their education level, said they segregate biomedical wastes according to their type and dispose them in their respective bins in both hospitals except forrespondents with<diploma in MCM. In addition, BMWM practice was significantly (P≤0.05) associated with job category of respondents for MCM hospital. There was no significant association for Zewditu hospital. Similar to the educational level, having training of BMWM significantly associated with one variable (labelling BMW container) that measured practice. Other variables weren't significantly associated. The presence of guideline significantly (P≤0.05) associated with respondent BMWM practice in Zewditu hospital. Except for one variable (labelling of BMW container) that measured practice, all other practice variables were not significantly associated with presence of guideline (Table 4.7).

Table 4.8 shows among the variables that measure practice of BMWM, labelling of BMW containers were significantly correlated with age and work experience of respondents.

Table 4.9, we can see that the availability of visual aid, availability of sufficient gloves, and availability of all 3 bins (black bin, yellow bin and safety box) were found to be significant with practice on BMWM (p< 0.05).

Table 4.10: Pearson's Correlation of Knowledge, Attitude, and Practice

		Practice
Knowledge	Pearson Correlation	.517**
	Sig. (2-tailed)	.000
	N	193
Attitude	Pearson Correlation	.136
	Sig. (2-tailed)	.060
	N	191

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

Table 4.10shows that knowledge is associated with practice at significant level of p value =0.000 which less than the required p value = 0.05. And we can also see their relation is positive. That means the level of practice of BMWM of health workers increased when their level of knowledge increased. However, in this study attitude is not significant at p value = 0.06 that is greater than the required p value= 0.05, this indicated that the level of attitude of HCPs was not associated with their practice of handling BMWM.

4.4.4. Linear regression results

The dependent variables are knowledge, attitude, and practice. To check for the assumption of linear regression model, normally for each dependent variable was checked using the Shapiro-Wilk and Kolmogorov-Smirnova tests (**Error! Not a valid bookmark self-reference.**).

Table 4.11: Tests of Normality

No.	Dependent variable	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
1.	Knowledge	0.166	191	0.000	0.912	191	0.000
2.	Attitude	0.111	191	0.000	0.957	191	0.000
3.	Practice	0.224	191	0.000	0.840	191	0.000
a. Lilliefors Significance Correction							

From Table 4.10shows that knowledge is associated with practice at significant level of p value =0.000 which less than the required p value = 0.05. And we can also see their relation is positive. That means the level of practice of BMWM of health workers increased when their level of knowledge increased. However, in this study attitude is not significant at p value = 0.06 that is greater than the required p value= 0.05, this indicated that the level of attitude of HCPs was not associated with their practice of handling BMWM.

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Table 4.11, we can see that the Shapiro-Wilk test is significant at $P \leq 0.01$ for all dependent variables, which indicated that they satisfy the normally assumption. Another assumption of linear regression that was checked was ANOVA (Table 4.12)

Table 4.13: ANOVA Table for Knowledge, Attitude, and Practice

No.	Dependent Variable	Model	Sum of Squares	Df	Mean Square	F	Sig.
1.	Knowledge	Regression	117.291	3	39.097	11.032	0.000
		Residual	832.818	235	3.544		
		Total	950.109	238			
		Predictors: (Constant), presence of guideline on BMWM, level of education, taking training on BMWM or related issue					
2.	Attitude	Regression	37.577	2	18.788	1.109	0.332
		Residual	3964.044	234	16.940		
		Total	4001.620	236			
		Predictors: (Constant), level of education, hospital type					
3.	Practice	Regression	52.828	3	17.609	10.560	0.000
		Residual	313.500	188	1.668		
		Total	366.328	191			
		Predictors: (Constant), Professional category, availability of sufficient gloves, availability of black, yellow bin and safety box					

FromTable 4.13, we can see that using the model is better than guessing the mean for Knowledge and Practice dependent variables since the value of the F statistic is significant at a significance level of 0.001. However, the F statistic is not significant for the dependent variable: "Attitude", indicating that using the model is not better than guessing the mean. That means there is not major factor for the "Attitude" dependent variable.

Multicollinearity is another assumption of linear regression that was checked we can also see that there is not Multicollinearity problem because a variance inflation factor (VIF) greater than 2 is usually considered to be problematic in which all values of VIF are below 2 (Table 4.14).

Table 4.14: **Regression coefficients for Knowledge, Attitude, and Practice**

No.	Dep. Var.	Variables	Unstandardized Coefficients		Stand.Coefficients	T	Sig.	95.0% Confidence Interval for B		Collinearity diagnostics
			B	Std. Error	Beta			Lower Bound	Upper Bound	VIF
1.	**Knowledge**	(Constant)	16.21	0.567		28.59	**0.000**	15.09	17.322	
		Presence of guideline on BMWM the section	0.48	0.165	0.184	2.93	**0.004**	0.16	0.810	1.060
		Level of education	0.42	0.140	0.184	2.98	**0.003**	0.14	0.695	1.022
		previous training on BMWM	0.67	0.254	0.165	2.62	**0.009**	0.17	1.167	1.065
2.	**Attitude**	(Constant)	32.14	1.197		26.86	**0.000**	29.79	34.500	
		hospital type	0.249	0.554	0.029	0.450	0.653	-0.841	1.340	1.001
		level of education	0.441	0.308	0.093	1.432	0.153	-0.166	1.047	1.001
3.	**Practice**	(Constant)	13.41	0.735		18.25	**0.000**	11.96	14.860	
		Professional category	-1.08	0.307	-0.240	-3.53	**0.001**	-1.69	-0.479	1.012
		Availability of sufficient gloves	0.79	0.228	0.235	3.48	**0.001**	0.343	1.244	1.007
		Availability of 3 bins (black bin, yellow bin and safety box)	0.56	0.271	0.141	2.07	**0.040**	0.026	1.094	1.019

FromTable 4.14, the major factors for Knowledge are: Presence of guideline on BMWM in their department, Level of education, and previous training on BMWM or related issues. The knowledge of participants who said "Yes" for the question "Presence of guideline" is higher than the knowledge of participants who said "No" considering other variables constant. This indicated that presence of guideline is very important in order to increase the knowledge of people on BMWM. As the level of education increases by 1 unit, the knowledge on BMWM increases by 0.42 considering the other variables constant. Participants who took training on BMWM have higher knowledge than those who did not take training. This means that training on BMWM is useful to increase the knowledge of BMWM. The major factors for practice are: Professional category, Availability of sufficient gloves quantity in your facility, and Availability of all 3 bins (black bin, yellow bin and safety box) in your department/ section. The knowledge on BMWM of cleaners is lower than that of health professionals. Participants who said "Yes" for "Availability of sufficient gloves quantity in the facility" have 0.79 times higher good practice than those who said "No" to this question. Participants with high availability of all 3 bins are more likely to have high good practice of BMWM. This indicated that availability of gloves and availability of all 3 bins is useful to increase the good practice of HCPS on BMWM.

The model for Knowledge is:

$$Y_{know} = 16.21 + 0.48PG\_OD + 0.42ED - 0.67TT$$

Where:

(1) PG_OD indicated for Presence of guideline/operational document for BMWM
(2) ED indicated for level of education
(3) TT for Taking training on BMWM

The model for Practice is:

$$Y_{Prac} = 13.41 - 1.08PC + 0.79ASG - 0.56A3B$$

Where:

(1) PC indicated for Professional category
(2) ASG indicated for availability of sufficient gloves quantity in your facility
(3) A3B for availability of all 3 bins in their department/section

4.4.6. Results of KAP scores

Concerning to knowledge, 11 questions were given. A correct answer was given 1 point and wrong answer was 0. Total values range from 0-11. Concerning to attitude, respondents were asked five questions with 2 negative, 1 neutral, and 2 positive statements. The five questions were changed into three questions by merging the two negative statements into one negative statement and the two positive statements into one positive statement. As a result, 9 questions were given coded as 0 for negative statements, 1 for Neutral statements, and 2 for positive statements resulting in total values ranging from 0-18. Concerning to practice, 8 questions were given. A correct answer was given 1 point and wrong answer was 0 in which the total values range from 0-8.

Table 4.15:Descriptive statistics of sum of KAP Scores

No.	Dependent Variable	Mean		Std. Dev.		Min		Max		Total
		Zewditu	MCM	Zewditu	MCM	Zewditu	MCM	Zewditu	MCM	Mean
1.	Knowledge	8.35	8.40	2.29	1.39	2	5	11	11	8.37
2.	Attitude	13.28	13.66	2.47	1.20	0	10	18	16	13.42
3.	Practice	6.68	6.68	1.44	1.32	1	3	8	8	6.68

FromTable 4.15;we can see that the mean of the sum score of knowledge, attitude, and practice are 8.37, 13.42, and 6.68 respectively.

Table 4.16: Summary of KAP scores after classification of levels using Bloom's cut off points.

No.	Variables	Category	N		Valid %		Total	
			Zewditu	MCM	Zewditu	MCM	N	%
1.	Knowledge	Inadequate	30	9	19.7	10.0	39	16.1
		Moderate	40	41	26.3	45.6	81	33.5
		Adequate	82	40	53.9	44.4	122	50.4
2.	Attitude	Negative	16	4	10.7	4.5	20	8.4
		Neutral	109	76	73.2	86.4	185	78.1
		Positive	24	8	16.1	9.1	32	13.5
3.	Practice	Poor	9	2	8.0	2.5	11	5.7
		Fair	29	31	25.9	38.3	60	31.1
		Good	74	48	66.1	59.3	122	63.2

The sum of KAP scores were then classified into 3 levels of knowledge (high, moderate, low), attitude (Negative, Neutral, Positive), and Practice (Poor, Fair, Good) based on Bloom's cut off point (<59%, 60%-79%, 80%-100%). The result in Table 4.16 shows 53.9% of Zewditu and 44.4% of MCM hospital health care workers have adequate knowledge, 16.1% of Zewditu and 9.1% of MCM have positive attitude and 66.1% of Zewditu and 59.3% of MCM have good practice regarding biomedical waste management (BMWM).

4.5. Discussion of results

4.5.1. Discussion on the results of descriptive statistics of quantitative data

Socio-demographic profile of health care workers

From the results, total of 246 respondents participated in the study. The percentage of females (66.7%) was higher than that of males (33.3 %) in Zewditu and 64.4% and 35.6% respectively in MCM hospital. The average work experience of respondents in years was 10 in Zewditu and 7 in MCM. In addition, 46.1% of the respondents in Zewditu and 34.4% in MCM had training on BMWM respectively.

This shows that public hospitals are given much training opportunities by government or other concerned bodies. In 20.2% of participants in Zewditu and 22.2% of MCM HCPs section there were no guidelines about BMWM which may in turn affect their practice. Availability of gloves in the health care facilities was 69.2% and 64.9% in Zewditu and MCM hospitals respectively.

Knowledge of health care workers on medical waste disposal

84(54.5%) of Zewditu and 32(35.6%) of MCM hospital respondents know the internationally accepted biohazard symbol by WHO. Safety box is known by majority of the respondents in both hospitals as disposal material for puncture causing materials like needle, 77.3% and 93.3% of Zewditu and MCM respondents respectively.

Most of HCWs 116(75.3%) at zewditu hospital has knowledge that a safety box should be disposed when it is $3/4^{th}$ full. Likewise, much greater respondents of MCM hospital 51(56.7%) know how maximum full should a safety box be. Greater number of HCPs in both hospitals 79.2% from Zewditu and 82.2% from MCM has knowledge on BMWM. The results of this study are similar to a study which was conducted in 2013 to assess the knowledge and practice on biomedical waste management among the health care workers working in Bagepalli Taluk.

The percentage of health care workers who had knowledge of medical waste disposal is higher than the one for those who were not knowledgeable Percentage of midwifes (100.0%) and laboratory technicians (82.4%) are likely to have better knowledge than those of medical doctors (69.6%). nurses (79.5%), health officers (46.2%) and cleaners (52.4%)at Zewditu hospital. This result contradicts with a study that was conducted in 2011 at Allahabad City,

on knowledge, attitude and practices about biomedical waste management among health care workers indicated that nurses had better knowledge than other health care categories (Mathur, Dwivedi, Hassan &Misra, 2011).

Annex 1, (Table 8) shows the percentage of those who had training (71.1%) of Zewditu and (96.8%) of MCM respondents had better knowledge on BMWM when compared to those who had no training, 28.9% and 25.4% of Zewditu and MCM respectively. A substantial percentage was males (78.4 %) Zewditu and (87.5%) MCM who have knowledge on disposal of medical waste than those who did not had. The females who had knowledge (48.6 %) were greater than those who did not. The chi-square test of gender and knowledge greater than the acceptable value of 0.05 and this implies that gender does not have association with knowledge. A study which was conducted at 45 Bagepalli Taluk in 2013 to assess knowledge and practice on medical waste disposal among health care workers working in primary health care centres also showed that there was no statistical relationship between knowledge and gender (Nagaraju et al., 2013).

Attitude of health care workers on medical waste disposal

85(55.2%) respondents of Zewditu hospital and (43.3%) of MCM respondents strongly agreed that improperly managed BMWs transmit infection and (5.2%) of them have the attitudes that it does not transmit and none of them in MCM disagreed. In BMW segregation at the point of generation (53.2%) of Zewditu hospital respondents strongly agreed. Also (59.1%) of Zewditu and (61.8%) of MCM said strongly agreed that wearing PPE helps to reduce risk of infection.

In Ethiopia there are three health care waste management (guidelines prepared by federal ministry of health (Federal Ministry of Health (FMoH), 2008), federal environmental protection authority, (Federal Environmental Protection Authority (FEPA), 2004) and Ethiopian Food, Medicine and Healthcare Administration and Control Authority (Ethiopia Food, Medicine and Health Care Administration and Control Authority (FMHACA), 2005). However, in this study less than half (37.7%) Zewditu and (40.0%) MCM (Table 4.2 indicated the average age of the respondents was (34) in Zewditu and (33) in MCM, and in both hospitals very young to well experienced adult professionals were participated which may contribute to obtain the data from different groups.Meanwhile, their work experience varies from new once to 35 yrs. in Zewditu and 1yr to 26 yrs. in MCM. And the average work

experience is 10 in Zewditu and 7 in MCM. Their experience will help to know their knowledge, attitude and knowledge about BMWM.

This result was worse than studies conducted at West Gojjam health centres where the guideline document was not available in any of the surveyed health centres and Gondar town (96.9%) (Azage, Kumie, 2010, Yenesew, Moges, Woldeyohannes, 2012). The possible explanation for this difference might be due tostudy time period difference which might be related to the increased attention given for infection prevention. However, similar study was found in Nigeria where 52.4% study participants did not access guidelines (Sabageh, Adeomi, Adediran et al., 2015). This difference might be due to cultural background difference, motivation from infection prevention authorities, academic knowledge deference or governmental attention for infection prevention.

The increased attitude that HIV may be transmitted through BMWs is 53.9% among Zewditu HCPs and 43.8% among MCM. A study conducted at Gondar town revealed a better result on transmission of HIV through BMWs (97.7%) (Yenesew, Moges, Woldeyohannes, 2012). This difference might be due to educational back ground, training and good practices of handling BMWs by HCPs.

The percentage (56.9%) of male respondents who strongly agreed that improperly managed BMWs may because infection is almost equal to the percentage of females (54.9%).

With regard to waste segregation and treatment, about 53.4% and 37.5% study participants agreed about BMW segregation at source Zewditu and MCM respectively. A contradicting study to this study was found in India regarding waste segregation at source (88.1%). Nonetheless, attitude on BMW treatment before disposal was better than the current study (88.7) (Karmakar et al., 2016). This difference might be due to less attention given in the current study for waste disposal and impacts of BMW on community health in general.

Practice of health care workers on medical waste disposal

The majority of the respondents in both hospitals have good practices of handling BMWs. Disposing sharp wastes in to a safety box for instance; BMWM was practiced by 87.0% and 98.9% of Zewditu and MCM respectively. Majority of respondents use gloves while handling BMWs, 96.8% and all of the participants in Zewditu and MCM respectively.

In this study, the highest BMWM was practiced among laboratory technicians (92.3%) followed by midwifes (76.9%) and the list practice score was disappointingly among medical doctors (53.4%) in Zewditu hospital. One could ask if over qualification leads to ignorance. However, this result was better than a study conducted in Bangladesh where about 56% medical doctors and 44.0% cleaning staff had good practice regarding medical waste management (Sarker, et al., 2014). This difference could be due to lack oftraining, staff commitment, motivation and enforcement from concerned bodies, ignorance, job dissatisfaction, lack of waste management equipment. Similarly, a study conducted in India indicated that the highest practice score was among Nurses (97.3%) followed by doctors (77.8) and the list was among cleaners (Ray *et al.*, 2014).

Health care workers have the responsibility to protect the community and other staff members through implementation of waste management policies. Probably this difference might be due to accessibility of BMWM equipment as most of (89.4%) Zewditu and (96.6%) MCM study participants in this study used colour coded bins.

With regard to glove usage, about 98.2% for Zewditu and (100.00%) MCM HCPs were always used while handling/working with BMWs, which is higher than a study conducted in Nigeria (69.2%) by Mbarki*et al.* (2013). Probably this difference might be due to perception difference of study participants or lack of glove. (Table 4.9)

Biomedical waste segregation is the most important step for proper waste management as it reduces the amount of infectious waste generated, waste treatment cost and risks associated with mismanagement of wastes. It should be done at the point of waste generation using different colour coded waste bins (Chartier et al., 2014). In this study 89.4% ofZewditu and 96.9% of MCM HCPs followed color coding segregation, which is higher than 80.6% and 21.7% in studies conducted in Agartalaand India respectively (Karmakaret al., 2016 and Uchechukwu et al., 2017). Probably this difference might be due to lack of training, waste

management equipment, strict follow-up and motivation or it might be due to workload, work experience, individual commitment for waste management/ infection.

The most eff ective PPE in reducing risk of injury for medical staff are gloves to protect them from exposure of blood and other potentially infectious materials. They are obligatory and must be always used while handling or working with BMWs (Chartier et al., 2014). In this study 70.7% and 66.7 %HCPs from Zewditu and MCM hospital respectively, always used gloves indicating that there are HCPs that still handle BMWs without using PPE. Probably this gap might be due to lack of sufficient PPE access in their HCFs or it might be due to ignorance or negligence of infections associated with improper handling of BMWs. Similarly, heavy duty glove and boots were used to protect cleaners from sharp injuries and aprons from splash of liquid infectious substances (FMoH, 2008).

In our study, observational checklists revealed a better result in which about 81.0% and 87.3% cleaners used heavy-duty glove from Zewditu and MCM hospital respectively. This gap might be due to lack of appropriate PPE supply or lack of awareness as they were educationally low level. Cleaners disclosed lack of PPEs in the facilities.

The other observation was, according to guidelines BMWs should not be stayed more than 24 hours in the health care delivery rooms (Chartier et al.; FMHACA, 2005; FMoH, 2008; FEPA, 2004). In observation results cleaners collected wastes from service area within the prescribed time schedule (24 hours) which was a much-appreciated activity. Similarly, according to guidelines BMWs should be transported separately as they were segregated with closed containers (Chartier et al.; FMHACA, 2005; FMoH, 2008). However, only (52.4%) Zewditu and (75.0%) MCM of cleaners separately transport BMWs as they were initially segregated and closed waste containers during transport respectively. This gap might be due to lack of appropriate waste transporting equipment, lack of awareness on importance of waste segregation or work overload.

Observations of health care facility waste disposal system

In both studied HCFs there was no central waste storage room (facility) rather they used puncture resistant containers (bins) to store until treatment. Most of them were stationed inside the door where they were originally generated. Both hospitals did not fence their burning area/incinerator and they were easily accessible. This practice was against the guideline that all incinerators /burning areas must be fenced to prevent access by the

community or animals (Ethiopia Food, Medicine and Health Care Administration and Control Authority (FMHACA, 2005). In addition to these three methods, depicted inTable 4.1, it was observed that BMW disposal system of Zewditu hospital is incineration, chemical treatment and burning Zewditu hospital used a bath (through) which has a capacity of holding $8m^3$ of wastes for a temporary waste storage container and incinerator chamber as a final disposal means. (See Figure 6 below) MCM hospital uses the modern sterilization method of BMW disposal but the highest technologies like autoclaving were not available in both hospitals.

Figure 6: Final waste disposal system of Zewditu hospital (An Incinerator)

4.5.2. Discussion on results of bivariate and linear regression analyses

Knowledge and associated factors

In the bivariate analysis, except gender, all independent variables (age, educational level, job category, having training and presence of guideline in the sections) of study participants showed statistically significant association with knowledge of study participants in both hospitals as stated in detail Annex 1, (Table 1-12). After checking multicollinearilty problem, from Table 4.14, the major factors that are associated with the knowledge of HCPs were: Presence of guideline/operational document for BMWM or infection prevention in their department/section, Level of education, and Taking training on BMWM or related issues. More than half (62.4%) Zewditu and (67%) MCM of HCPs did not access any of these or other similar guidelines/ operational documents related to waste management in their department. This result was better than studies conducted at West Gojjam health centres where the guideline document was not available in any of the surveyed health centres and

Gondar town (96.9%) (Azage and Kumie, 2010). The possible explanation for this difference might be due to study time period difference, which might be related to the increased attention given for infection prevention.

Attitude and associated factors

As shown in Annex 1, (Table 13-24), though the result showed there is association between independent variables (hospital type and level of education) with the attitude of HCPs, after computing linear regression, they are less likely to contribute to the attitude of HCPs with p value. We can see that majority of the respondents (87.25%) Zewditu and (91.0%) MCM HCPs have agreed that improperly managed BMWs may cause infection. A recent finding in Tripura, India indicated that almost all studied participants had good attitude regarding BMWM (Karmakar N. et al, 2016). On the other hand, a study conducted in Nigeria showed a lower finding in which only 45.5% of HCWs had positive attitude (Sabageh A. et al., 2015). This difference might be due to study participant perception difference on the impact of BMWs, lack of accessible guideline or other waste management documents which might have an important implication on the individuals' perception.

Practice and associated factors

For the dependent variable practice, in addition to the variables that measures knowledge and attitude, two additional healthcare facility factors (Availability of sufficient quantity of gloves and availability of all 3 bins (black bin, yellow bin and safety box) in the facility) were tested for association with the practice of HCPs. The major factors for practice are: Professional category, Availability of sufficient gloves quantity in your facility, and Availability of all 3 bins (black bin, yellow bin and safety box) in the department/ section (Annex 1 Table 25-36)

Knowledge attitude and practice with age and work experience

As shown in Annex 1, (Table 1-36), knowledge about handling BMWs increased as age and work experience of the respondents increased. The attitude of respondents on HIV and HBV transmission through biomedical wastes in association with age and work experience is significant. Their practice of labelling of biomedical wastes as infectious and non-infectious increased with age and work experience. According to national guideline, all HCWs who handle infectious waste should receive infectious waste management training at least once a year (FMoH, 2008). When they practice colour coding segregation, they might get knowledge about BMWM and this knowledge intern could bring attitudinal change of

HCWs. This might be due to information from guideline might bring knowledge change and this knowledge change might in turn bring attitudinal change.

Association between knowledge Vs practice and attitude Vs practice

The result from Pearson's correlation (Table 4.10) showed that knowledge is associated with practice at significant level of p value =0.000 which less than the required p value = 0.01. And we can also see their relation is positive. That means the level of practice of BMWM of health workers increased when their level of knowledge increased. The results of another study which was conducted in the hospitals of Gondar Town in 2013 on medical waste disposal practices among health care workers also shows that knowledge on medical waste types, diseases transmitted through contact with infectious waste, training and availability of guidelines was significantly associated with health care waste management practice (Muluken, Haimanot&Mesafinit, 2013). However, in this study attitude is significant at p value = 0.06 that is greater than the required p value= 0.01, this indicated that the level of attitude of HCPs was not associated with their practice of handling BMWM.

KAP scores

Table 4.16 shows knowledge score of Zewditu hospital health workers (55.9%) were found to have adequate knowledge on BMWM when compared to those of MCM health workers (44.4%). This difference is may be due to training opportunities are mostly given for public hospitals. Attitude was not associated with practice of healthcare workers as shown in the result, it has very less association (16.1%) of Zewditu and (9.1%) of MCM have positive attitude about BMWM. Again, high percentage of Zewditu (66.1%) HCPs have good practice of handling BMWs than MCM HCPs (59.3%). Presence of guidelines about BMWM that are brought during trainings for public hospital might have rated the difference.

Summary

This chapter has described the results of the study of knowledge attitude and practice of health care worker on disposal of medical waste by comparing public (Zewditu) and private (MCM) hospital Addis Ababa. The results focused on descriptive statistics and inferential statistics analyses of quantitative and qualitative data. Socio-demographic profile of health care workers, knowledge, attitude and practice, association of demographic factors and health related factors to knowledge, attitude and practice, association between knowledge and practice, association between attitude and practice, regression analysis of associated factors, and Discussion of results was explained.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

Chapter 5 summarizes the conclusions and recommendations emanating from this study. It begins by looking at a summary of the initial aims and objectives, its rationale, and a synopsis of the literature findings. It then includes a brief discussion presented according to each of the main research questions followed by the outcomes of this study. The limitations and the special contributions of this study are covered in this section. It concludes with a list of recommendations.

5.2. Summary of Research Findings

From the results of descriptive statistics, out of 243 respondents, the percentage of females was higher than that of males in both hospitals; Zewditu and MCM hospital. The average work experience of respondents in years was higher in Zewditu than in MCM hospital.

Observational checklist result showedabout 81.0% and 87.3% cleaners used heavy-duty glove from Zewditu and MCM hospital respectively.

In both studied HCFs there was no central waste storage room (facility) rather they used puncture resistant containers (bins) to store until treatment. Most of them were stationed inside the door where they were originally generated. Both hospitals did not fence their burning area/incinerator and they were easily accessible.Itwas observed that BMW disposal system of Zewditu hospital is incineration, chemical treatment and burning Zewditu hospital used a bath (through) which has a capacity of holding $8m^3$ of wastes for a temporary waste storage container and incinerator chamber as a final disposal means. MCM hospital uses the modern sterilization method of BMW disposal but the highest technologies like autoclaving were not available in both hospitals.

From the KAP scores, the percentage of respondents who had adequate knowledgeon BMWM is higher for Zewditu hospital (55.9%) HCPs than for MCM hospital (44.4%) HCPs. 16.1% of Zewditu HCPs and 9.1% of MCM HCPs had positive attitude about BMWM, which indicated that the respondents who had positive attitude is higher for Zewditu respondents than for MCM respondents. High percentage of Zewditu (66.1%) HCPs have good practice of handling BMWs than that of MCM HCPs (59.3%).

The bivariate analysis results showed that the sum of scores for knowledge was associated with work experience, hospital type, professional category, level of education, taking training on BMWM, and Presence of guidelines about BMWM at 5% level of significance. Knowledge about handling BMWs increased as age and work experience of the respondents increased.

The sum of scores for attitude was associated with level of education and hospital type at 5% level of significance. Attitude was not associated with practice of healthcare workers.

The sum of scores for practice was associated with professional category, level of education, job category, taking training on BMWM, availability of sufficient gloves, presence of guidelines, and availability of all 3 bins at 5% level of significance. The Pearson's correlation showed that knowledge is positively associated with practice at 5% level of significance, which indicated that the level of practice of BMWM of HCWs increased when their level of knowledge increased.

From the results of multiple linear regression analysis, the major factors that affect the knowledge of HCWs were: Presence of guideline/operational document for BMWM or infection prevention in their department/section, Level of education, and Taking training on BMWM. The knowledge of HCWs increased when guideline/operational document are available for BMWM.

The major factors that affect the practice of HCWs were: professional category, availability of sufficient gloves quantity in the facility, availability of all 3 bins in the department. This indicated that the availability of all 3 bins increase the practice of HCWs on BMWM. The availability of sufficient gloves also increased the practice of HCWs on BMWM.

5.3. Research Conclusions

The objectives of this research were to:

- Assess the knowledge, attitude and practice of healthcare workers towards Bio-Medical waste management
- Determine factors associated with the knowledge, attitude and practice of HCWs towards BMWM
- Determine the relationship between attitude versus practice and knowledge versus practice

KAP among health workers have been identified and the findings of the data collected discussed. The results showed knowledge score among Zewditu HCPs were and (44.4%) among MCM HCps. Positive attitude scores were (16.1%) and (9.1%) for Zewditu and MCM HCPs respectively. High percentage of HCPs with good practice were among Zewditu hospital (66.1%) and (59.3%) were among MCM.This could be may be due to the implementation of some programs on public hospitals such as EHSTG (Ethiopian Hospital Standard Transformation Guideline) and CASH (Clean and Safe Hospitals) which is launched by the Federal ministry of health which put public hospitals on to competition and the best performers are awarded.

The findings showed that the practice of BMW increases as the level of education of HCPs increase. Even though it is not comparable, HCPs were having better knowledge and attitude than cleaners whereas; cleaners had relatively better practice than HCPs.

The study has shown those HCPs who had training on BMWM or related issues were likely to have good practice of handling BMWs than those who hadn't. And much of the respondents for who guidelines were available in their section, have good knowledge and practice about BMWM.

Overall awareness and knowledge of biomedical waste management was better among all the health workers in our study, comparable to the findings by other studies done in different parts of the country (Chudasama RK. et al, 2013). On the contrary few other studies have found out poor level of awareness and knowledge on biomedical waste management among the participants (Patil et al, 2013). This could be due to differences in the study settings, differences in job profile and experience of the participants, differences in data collection tools used etc. Segregation of biomedical waste was found to be satisfactory among health care workers in our study similar to the findings of few other studies done in different settings (Bansal, et al.,2011, Malini. et al,2015) however, many other studies have found poor waste management practices among HCPs.

Regarding associated factors with KAP of study participants, the knowledge and practice of health workers is directly related to the age and work experience. There was also statistically significant association between knowledge and practice. But in this study attitude was found to have no association with practice.

According to the observation result, both hospitals' final waste disposal system was incineration, which still is not latest technology. The researcher hopes that the study will

provide a baseline of knowledge and practice of health care workers with regard to disposal of medical waste. This baseline may be used by the hospital management to develop an improvement plan to address the identified gaps. A future study which could be conducted could focus on liquid medical waste management of healthcare institutions.

5.4. Recommendations

Proper disposal of medical waste is of great importance to protect the employees, the environment and the public against health risks. Some recommendations are here:

- Firstly, better results can be obtained for the proper biomedical waste disposal if the management focus and work on the gaps identified by this study especially on the major associated factors that are related to the knowledge, attitude and practice of healthcare workers.
- Secondly, there should be regular training of all categories of workers on disposal of medical waste in order to improve their knowledge on disposal of medical waste.
- The other possible solution would be regular waste management inspections by the waste management committee, which helps to identify areas, which needs intervention regarding disposal of medical waste.
- The most important thing that should be done to overcome the problem of improper BMWM is law enforcement by the government on HCFs is required to able them to strictly follow the IP guideline. The infection prevention guideline consists of all-important health facility equipment's that must be available and set direction on how to dispose BMWs properly.
- For the private hospitals CASH (Clean and Safe Hospitals) and (Ethiopian Hospital other IP (Infection Prevention) guideline should be implemented like those of the public ones
- It is also advisable if both Public and private hospitals exchange their best practices for better attainments
- Lastly, much attention is not normally given to BMWM by hospital managements and hospital managements and other concerned body must work on the issue of BMWM and should plant latest technologies of biomedical waste treatment and disposal

system and whatever it takes to minimize the risks associated with poor BMWM and safe guard the environment.

- The last recommendation is to further study the liquid BMWM of HCFs as this study is only the result of solid BMWs

5.5. Avenues for Further Research

Hospital wastes can be divided as solid biomedical waste and liquid biomedical waste. This study was based on solid biomedical wastes only. So, it is recommendable to further investigate about liquid biomedical waste management of healthcare institutions.

5.6. Limitations of the Study

Busy schedules and staff rotations of healthcare workers posed a major challenge to data collection. Some institutions who directly or indirectly contribute to accomplishment of this study, like universities, Addis Ababa Health bureau and HCFs were busy handling the current global health problem, COVID-19; hence, they made their facilitation and cooperation a little bit tuff. Meanwhile, the study has taken directions to solve these challenges as follows.

- ❖ The study took extended time for collecting the data, by going every other day to meet new participantsaftertheir day-off.
- ❖ Sacrificing other operations and giving much more time for this study and patiently approaching every step in every institution were the only way to mitigate the problem.

Overall, this study has ensured all the required inputs as much as possible and paid attention for data quality assurance thereby it has considered all the necessary measures and made a continuous follow up in carrying out the research.

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ANNEXES

Annex 1: Descriptive Stastics of Socio Demographic Factors and the KAP of health workers

Table 1: Gender and variables that measure knowledge

No.	Variables	Category	hospital type							
			Zewditu				MCM			
			Gender		Gender					
			Male		Female		Male		Female	
			N	Col.Val.N %	N	Col.Val.N %	N	Col.Val.N %	N	Col.Val.N%
1.	knowing about biomedical waste management	No	11	21.6%	21	20.6%	4	12.5%	12	20.7%
		Yes	40	78.4%	81	79.4%	28	87.5%	46	79.3%
2	health hazard associated with biomedical wastes	No	7	13.7%	12	11.8%	0	0.0%	0	0.0%
		Yes	44	86.3%	90	88.2%	32	100.0 %	58	100.0%
1	wearing PPE reduce risk of infection	No	3	5.9%	6	5.9%	0	0.0%	0	0.0%
		Yes	48	94.1%	96	94.1%	32	100.0 %	58	100.0%
2	knowing about color coding segregation of BMW	No	9	17.6%	33	32.4%	13	40.6%	29	50.0%
		Yes	42	82.4%	69	67.6%	19	59.4%	29	50.0%
3	Should infectiously waste containers be labeled with biohazard symbol?	No	10	19.6%	17	16.8%	0	0.0%	0	0.0%
		Yes	41	80.4%	84	83.2%	32	100.0 %	58	100.0%
4	Should BMW be segregated into different categories at the point of generation?	No	8	15.7%	12	11.9%	0	0.0%	0	0.0%
		Yes	43	84.3%	89	88.1%	32	100.0 %	58	100.0%
5	Do you know biohazard symbol	No	19	37.3%	50	49.0%	21	65.6%	37	63.8%
		Yes	32	62.7%	52	51.0%	11	34.4%	21	36.2%
6	Do you know type of BMW to be disposed in yellow bin	No	18	35.3%	33	32.4%	10	31.3%	25	43.1%
		Yes	33	64.7%	69	67.6%	22	68.8%	33	56.9%
7	Do you know type of BMW to be disposed in black bin	No	23	45.1%	42	41.2%	12	37.5%	26	44.8%
		Yes	28	54.9%	60	58.8%	20	62.5%	32	55.2%
8	Do you know puncture causing supplies disposal material	No	9	17.6%	26	25.5%	1	3.1%	5	8.6%
		Yes	42	82.4%	76	74.5%	31	96.9%	53	91.4%
9	Do you know how maximum full should be a safety box	No	9	17.6%	29	28.4%	14	43.8%	25	43.1%
		Yes	42	82.4%	73	71.6%	18	56.3%	33	56.9%

Table3: Educational level and variables that measure knowledge panel by hospital type

No.	Variables	Cat.	Hospital Type							
			Zewditu				MCM			
			Educational level				Educational level			
			< dipl.	Dipl.	First deg.	Mas.and above	< dipl.	Dipl.	First deg.	Mas.and above
			Col. Val.N %	Col. Val.N %	Col. Val.N %	Col. Val.N %	Col. Val.N%	Col. Val.N%	Col. Val.N %	Col. Val.N%
1.	BMWM	No	41.2%	11.8%	19.1%	19.2%	7.7%	15.4%	23.9%	11.1%
		Yes	58.8%	88.2%	80.9%	80.8%	92.3%	84.6%	76.1%	88.9%
2.	Health hazard	No	5.9%	0.0%	18.1%	7.7%	0.0%	0.0%	0.0%	0.0%
		Yes	94.1%	100.0%	81.9%	92.3%	100.0%	100.0%	100.0%	100.0%
3.	PPE	No	5.9%	17.6%	4.3%	3.8%	0.0%	0.0%	0.0%	0.0%
		Yes	94.1%	82.4%	95.7%	96.2%	100.0%	100.0%	100.0%	100.0%
4.	Color coding	No	52.9%	47.1%	24.5%	7.7%	53.8%	53.8%	45.7%	38.9%
		Yes	47.1%	52.9%	75.5%	92.3%	46.2%	46.2%	54.3%	61.1%
5.	Labeling	No	0.0%	35.3%	17.2%	19.2%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	64.7%	82.8%	80.8%	100.0%	100.0%	100.0%	100.0%
6.	Segregation	No	0.0%	23.5%	12.9%	15.4%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	76.5%	87.1%	84.6%	100.0%	100.0%	100.0%	100.0%
7.	Biohazard symbol	No	82.4%	64.7%	36.2%	42.3%	61.5%	69.2%	63.0%	66.7%
		Yes	17.6%	35.3%	63.8%	57.7%	38.5%	30.8%	37.0%	33.3%
8.	In yellow bin	No	64.7%	52.9%	24.5%	30.8%	84.6%	15.4%	34.8%	33.3%
		Yes	35.3%	47.1%	75.5%	69.2%	15.4%	84.6%	65.2%	66.7%
9.	In black bin?	No	35.3%	58.8%	38.3%	50.0%	76.9%	30.8%	37.0%	38.9%
		Yes	64.7%	41.2%	61.7%	50.0%	23.1%	69.2%	63.0%	61.1%
10.	Sharp supplies	No	35.3%	41.2%	19.1%	15.4%	15.4%	7.7%	6.5%	0.0%
		Yes	64.7%	58.8%	80.9%	84.6%	84.6%	92.3%	93.5%	100.0%
11.	How full a safety box be?	No	52.9%	29.4%	21.3%	15.4%	53.8%	46.2%	41.3%	38.9%
		Yes	47.1%	70.6%	78.7%	84.6%	46.2%	53.8%	58.7%	61.1%

Table5: Job category and variables that measure knowledge at zewditu hospital

No.	Variable	Catg.	Med. Doc	Nurse	Mid wife	Lab. Tech	HO	Cleaner
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	knowing about BMWM	No	13.0%	20.5%	0.0%	11.8%	38.5%	33.3%
		Yes	87.0%	79.5%	100.0%	88.2%	61.5%	66.7%
2	health hazard associated with BMWs	No	4.3%	15.1%	0.0%	11.8%	38.5%	4.8%
		Yes	95.7%	84.9%	100.0%	88.2%	61.5%	95.2%
3	wearing PPE reduce risk of infection	No	4.3%	5.5%	0.0%	5.9%	15.4%	4.8%
		Yes	95.7%	94.5%	100.0%	94.1%	84.6%	95.2%
4	knowing about colour coding segregation of BMWs	No	30.4%	20.5%	0.0%	17.6%	53.8%	47.6%
		Yes	69.6%	79.5%	100.0%	82.4%	46.2%	52.4%
5	Should infectiously waste containers be labelled with biohazard symbol?	No	4.3%	23.6%	28.6%	23.5%	23.1%	0.0%
		Yes	95.7%	76.4%	71.4%	76.5%	76.9%	100.0%
6	Should BMWs be segregated in to categories at the point of generation?	No	8.7%	15.1%	14.3%	17.6%	25.0%	0.0%
		Yes	91.3%	84.9%	85.7%	82.4%	75.0%	100.0%
7	internationally accepted symbol for biohazard	No	47.8%	37.0%	28.6%	41.2%	38.5%	85.7%
		Yes	52.2%	63.0%	71.4%	58.8%	61.5%	14.3%
8	type of BMWs to be disposed in a yellow biomedical waste disposal bin	No	30.4%	27.4%	14.3%	35.3%	30.8%	61.9%
		Yes	69.6%	72.6%	85.7%	64.7%	69.2%	38.1%
9	type of BMWs should be disposed in a black biomedical waste disposal bin	No	52.2%	35.6%	14.3%	52.9%	69.2%	38.1%
		Yes	47.8%	64.4%	85.7%	47.1%	30.8%	61.9%
10	material for disposal of medical supplies capable of causing puncture	No	17.4%	19.2%	0.0%	29.4%	38.5%	33.3%
		Yes	82.6%	80.8%	100.0%	70.6%	61.5%	66.7%
11	amount of fullness of safety box containing sharp medical supplies	No	30.4%	19.2%	28.6%	11.8%	23.1%	47.6%
		Yes	69.6%	80.8%	71.4%	88.2%	76.9%	52.4%

Table6: Job category and variables that measure knowledge at MCM hospital

No.	Variable	Cat	MCM					
			Med. Doc	Nurse	Mid wife	Lab. Tech	HO	Cleaner
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	knowing about BMWM	No	38.5%	34.8%	0.0%	0.0%	16.7%	6.3%
		Yes	61.5%	65.2%	100.0%	100.0%	83.3%	93.8%
2	health hazard associated with BMWs	No	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
3	wearing PPE reduce risk of infection	No	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
4	knowing about colour coding segregation of BMWs	No	76.9%	65.2%	7.7%	23.1%	41.7%	50.0%
		Yes	23.1%	34.8%	92.3%	76.9%	58.3%	50.0%
5	Should containers be labelled with biohazard symbol?	No	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
6	Should BMWs be segregated at the point of generation?	No	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
7	internationally accepted symbol for biohazard	No	53.8%	52.2%	76.9%	76.9%	66.7%	68.8%
		Yes	46.2%	47.8%	23.1%	23.1%	33.3%	31.3%
8	type of BMWs to be disposed in a yellow BMW	No	53.8%	30.4%	30.8%	30.8%	8.3%	75.0%
		Yes	46.2%	69.6%	69.2%	69.2%	91.7%	25.0%
9	type of BMWs to be dispose black disposal bin	No	61.5%	39.1%	38.5%	30.8%	8.3%	68.8%
		Yes	38.5%	60.9%	61.5%	69.2%	91.7%	31.3%
10	Using safety box for sharp medical wastes	No	0.0%	8.7%	7.7%	0.0%	8.3%	12.5%
		Yes	100.0%	91.3%	92.3%	100.0%	91.7%	87.5%
11	amount of fullness of safety box containing sharp medical supplies	No	69.2%	47.8%	23.1%	23.1%	33.3%	56.3%
		Yes	30.8%	52.2%	76.9%	76.9%	66.7%	43.8%

Table8: Training access and variables that measure knowledge panel by hospital type

No.	Variables	Catg.	Hospital type							
			Zewditu				MCM			
			Having training				Having training			
			No		Yes		No		Yes	
			N	C.V.N %	N	C.V.N %	N	C.V.N %	N	C.V.N %
1.	Do you know about BMWM	No	24	28.9%	8	11.3%	15	25.4%	1	3.2%
		Yes	59	71.1%	63	88.7%	44	74.6%	30	96.8%
2.	Is there health risk associated with biomedical wastes	No	15	18.1%	5	7.0%	0	0.0%	0	0.0%
		Yes	68	81.9%	66	93.0%	59	100.0%	31	100.0%
3.	Does wearing PPE reduce risk of infection	No	7	8.4%	2	2.8%	0	0.0%	0	0.0%
		Yes	76	91.6%	69	97.2%	59	100.0%	31	100.0%
4.	Do you about color coding segregation of BMW	No	31	37.3%	11	15.5%	38	64.4%	4	12.9%
		Yes	52	62.7%	60	84.5%	21	35.6%	27	87.1%
5.	Should infectiously waste containers be labeled with biohazard symbol?	No	14	17.1%	13	18.3%	0	0.0%	0	0.0%
		Yes	68	82.9%	58	81.7%	59	100.0%	31	100.0%
6.	Should BMW be at the point of generation?	No	13	15.9%	7	9.9%	0	0.0%	0	0.0%
		Yes	69	84.1%	64	90.1%	59	100.0%	31	100.0%
7.	Do you know biohazard symbol?	No	39	47.0%	31	43.7%	34	57.6%	24	77.4%
		Yes	44	53.0%	40	56.3%	25	42.4%	7	22.6%
8.	Do you know type of BMW to be disposed in yellow bin?	No	31	37.3%	20	28.2%	25	42.4%	10	32.3%
		Yes	52	62.7%	51	71.8%	34	57.6%	21	67.7%
9.	Do you know type of BMW to be disposed in black bin?	No	38	45.8%	27	38.0%	28	47.5%	10	32.3%
		Yes	45	54.2%	44	62.0%	31	52.5%	21	67.7%
10.	Do you know puncture causing supplies disposal material?	No	22	26.5%	13	18.3%	4	6.8%	2	6.5%
		Yes	61	73.5%	58	81.7%	55	93.2%	29	93.5%
11.	Do you know how maximum full should a safety box be?	No	23	27.7%	15	21.1%	30	50.8%	9	29.0%
		Yes	60	72.3%	56	78.9%	29	49.2%	22	71.0%

Table10: Presence of guideline and variables that measure knowledge panel by hospital type

No.	Variables	Catg..	Hospital type					
			Zewditu			MCM		
			Presence of guideline			Presence of guideline		
			No	Not sure	Yes	No	Not sure	Yes
			C.V.N%	C.V.N%	C.V.N%	C.V.N%	C.V.N%	C.V.N%
1.	Do you know about BMWM	No	28.1%	26.6%	10.3%	40.0%	23.5%	0.0%
		Yes	71.9%	73.4%	89.7%	60.0%	76.5%	100.0%
2.	Is there health risk associated with biomedical wastes	No	18.8%	14.1%	8.6%	0.0%	0.0%	0.0%
		Yes	81.3%	85.9%	91.4%	100.0%	100.0%	100.0%
3.	Does wearing PPE reduce risk of infection	No	9.4%	7.8%	1.7%	0.0%	0.0%	0.0%
		Yes	90.6%	92.2%	98.3%	100.0%	100.0%	100.0%
4.	Do you about color coding segregation of BMW	No	40.6%	34.4%	12.1%	75.0%	58.8%	19.4%
		Yes	59.4%	65.6%	87.9%	25.0%	41.2%	80.6%
5.	Should infectiously waste containers be labeled with biohazard symbol?	No	15.6%	18.8%	17.5%	0.0%	0.0%	0.0%
		Yes	84.4%	81.3%	82.5%	100.0%	100.0%	100.0%
6.	Should BMW be at the point of generation?	No	15.6%	17.5%	6.9%	0.0%	0.0%	0.0%
		Yes	84.4%	82.5%	93.1%	100.0%	100.0%	100.0%
7.	Do you know biohazard symbol?	No	56.3%	46.9%	37.9%	60.0%	50.0%	80.6%
		Yes	43.8%	53.1%	62.1%	40.0%	50.0%	19.4%
8.	Do you know type of BMW to be disposed in yellow bin?	No	46.9%	37.5%	20.7%	30.0%	41.2%	41.7%
		Yes	53.1%	62.5%	79.3%	70.0%	58.8%	58.3%
9.	Do you know type of BMW to be disposed in black bin?	No	43.8%	53.1%	29.3%	35.0%	44.1%	44.4%
		Yes	56.3%	46.9%	70.7%	65.0%	55.9%	55.6%
10.	Do you know puncture causing supplies disposal material?	No	21.9%	31.3%	13.8%	0.0%	8.8%	8.3%
		Yes	78.1%	68.8%	86.2%	100.0%	91.2%	91.7%
11.	Do you know how maximum full should a safety box be?	No	18.8%	34.4%	17.2%	70.0%	41.2%	30.6%
		Yes	81.3%	65.6%	82.8%	30.0%	58.8%	69.4%

ATTITUDE

Table13: Gender and variables that measure attitude

No.	Variable	cat.	hospital type							
			Zewditu				MCM			
			Gender				Gender			
			Male		Female		Male		Female	
			N	C.V. N %	N	C.V .N %	N	C.V .N %	N	C.V .N %
1	Improperly managed health care wastes may cause infection	SD	2	3.9%	3	2.9%	0	0.0%	0	0.0%
		D	1	2.0%	6	5.9%	0	0.0%	0	0.0%
		N	2	3.9%	7	6.9%	0	0.0%	0	0.0%
		A	17	33.3%	30	29.4%	15	46.9%	36	62.1%
		SA	29	56.9%	56	54.9%	17	53.1%	22	37.9%
2	HIV may be transmitted through BMW	SD	3	5.9%	5	4.9%	0	0.0%	0	0.0%
		D	1	2.0%	1	1.0%	0	0.0%	0	0.0%
		N	2	3.9%	12	11.8%	0	0.0%	1	1.8%
		A	17	33.3%	29	28.4%	16	50.0%	33	57.9%
		SA	28	54.9%	55	53.9%	16	50.0%	23	40.4%
3	Hepatitis B virus may be transmitted through BMW	SD	2	3.9%	3	3.0%	0	0.0%	0	0.0%
		D	0	0.0%	1	1.0%	0	0.0%	2	3.4%
		N	4	7.8%	9	8.9%	1	3.1%	7	12.1%
		A	17	33.3%	31	30.7%	16	50.0%	32	55.2%
		SA	28	54.9%	57	56.4%	15	46.9%	17	29.3%
4	Hepatitis C virus may be transmitted through BMW	SD	2	3.9%	1	1.0%	0	0.0%	0	0.0%
		D	3	5.9%	7	6.9%	0	0.0%	2	3.5%
		N	4	7.8%	10	9.9%	2	6.3%	6	10.5%
		A	18	35.3%	35	34.7%	15	46.9%	30	52.6%
		SA	24	47.1%	48	47.5%	15	46.9%	19	33.3%
5	BMW do not transmit any infectious diseases	SD	31	63.3%	61	60.4%	14	43.8%	22	39.3%
		D	10	20.4%	18	17.8%	17	53.1%	32	57.1%
		N	1	2.0%	9	8.9%	1	3.1%	1	1.8%
		A	4	8.2%	9	8.9%	0	0.0%	1	1.8%
		SA	3	6.1%	4	4.0%	0	0.0%	0	0.0%
6	BMW should be segregate into different categories at the point of generation	SD	3	5.9%	3	2.9%	0	0.0%	0	0.0%
		D	0	0.0%	5	4.9%	0	0.0%	1	1.7%
		N	4	7.8%	7	6.9%	1	3.1%	2	3.4%
		A	17	33.3%	32	31.4%	16	50.0%	39	67.2%
		SA	27	52.9%	55	53.9%	15	46.9%	16	27.6%
7	Labeling of BMW containers does not add value on BMWM	SD	27	52.9%	57	55.9%	8	25.0%	15	25.9%
		D	13	25.5%	15	14.7%	22	68.8%	29	50.0%
		N	6	11.8%	12	11.8%	0	0.0%	8	13.8%

		A	2	3.9%	10	9.8%	2	6.3%	4	6.9%
		SA	3	5.9%	8	7.8%	0	0.0%	2	3.4%
8	BMW disinfection can reduce the chance of contracting infection	SD	3	5.9%	4	3.9%	1	3.1%	1	1.7%
		D	4	7.8%	3	2.9%	1	3.1%	1	1.7%
		N	4	7.8%	15	14.7%	2	6.3%	8	13.8%
		A	17	33.3%	44	43.1%	18	56.3%	28	48.3%
		SA	23	45.1%	36	35.3%	10	31.3%	20	34.5%
9	Wearing PPE helps to reduce risk of infection	SD	3	5.9%	1	1.0%	1	3.1%	3	5.2%
		D	1	2.0%	2	2.0%	2	6.3%	0	0.0%
		N	3	5.9%	2	2.0%	0	0.0%	0	0.0%
		A	15	29.4%	35	34.3%	12	37.5%	17	29.3%
		SA	29	56.9%	62	60.8%	17	53.1%	38	65.5%

Table15: Educational level and variables that measure attitude panel by hospital type

No.	Variable	cat.	hospital type							
			Zewditu				MCM			
			Edu. Lev.				Edu. Lev.			
			< dipl.	Dipl.	First deg.	Mas.and above	< dipl.	Dipl.	First deg.	Mas.and above
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	Improperly managed health care wastes may cause infection	SD	0.0%	5.9%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	5.9%	11.8%	4.3%	3.8%	0.0%	0.0%	0.0%	0.0%
		N	17.6%	17.6%	2.1%	3.8%	0.0%	0.0%	0.0%	0.0%
		A	52.9%	41.2%	25.5%	26.9%	69.2%	53.8%	54.3%	55.6%
		SA	23.5%	23.5%	63.8%	65.4%	30.8%	46.2%	45.7%	44.4%
2	HIV may be transmitted through BMW	SD	0.0%	11.8%	5.3%	3.8%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%
		N	11.8%	11.8%	9.6%	3.8%	0.0%	0.0%	2.2%	0.0%
		A	47.1%	47.1%	26.6%	23.1%	66.7%	46.2%	54.3%	55.6%
		SA	41.2%	29.4%	56.4%	69.2%	33.3%	53.8%	43.5%	44.4%
3	Hepatitis B virus may be transmitted through BMW	SD	0.0%	11.8%	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	0.0%	1.1%	0.0%	15.4%	0.0%	0.0%	0.0%
		N	17.6%	17.6%	5.3%	8.0%	38.5%	7.7%	4.3%	0.0%
		A	35.3%	47.1%	29.8%	28.0%	38.5%	53.8%	54.3%	61.1%
		SA	47.1%	23.5%	60.6%	64.0%	7.7%	38.5%	41.3%	38.9%
4	Hepatitis C virus may be transmitted through BMW	SD	0.0%	5.9%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	11.8%	5.9%	5.4%	7.7%	15.4%	0.0%	0.0%	0.0%
		N	11.8%	11.8%	7.5%	11.5%	46.2%	0.0%	4.3%	0.0%
		A	35.3%	58.8%	32.3%	30.8%	30.8%	53.8%	52.2%	58.8%
		SA	41.2%	17.6%	52.7%	50.0%	7.7%	46.2%	43.5%	41.2%

5	BMW do not transmit any infectious diseases	SD	23.5%	41.2%	67.0%	76.9%	8.3%	46.2%	41.3%	58.8%
		D	35.3%	29.4%	15.4%	15.4%	83.3%	53.8%	54.3%	41.2%
		N	23.5%	0.0%	5.5%	3.8%	0.0%	0.0%	4.3%	0.0%
		A	11.8%	17.6%	7.7%	3.8%	8.3%	0.0%	0.0%	0.0%
		SA	5.9%	11.8%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%
6	BMW should be segregate into different categories at the point of generation	SD	0.0%	0.0%	6.4%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	5.9%	0.0%	3.2%	3.8%	7.7%	0.0%	0.0%	0.0%
		N	17.6%	17.6%	5.3%	0.0%	0.0%	0.0%	6.5%	0.0%
		A	47.1%	35.3%	28.7%	34.6%	61.5%	84.6%	56.5%	55.6%
		SA	29.4%	47.1%	56.4%	61.5%	30.8%	15.4%	37.0%	44.4%
7	Labeling of BMW containers does not add value on BMWM	SD	17.6%	47.1%	59.6%	65.4%	15.4%	15.4%	28.3%	33.3%
		D	29.4%	11.8%	16.0%	23.1%	38.5%	61.5%	63.0%	50.0%
		N	29.4%	23.5%	9.6%	0.0%	23.1%	23.1%	2.2%	5.6%
		A	17.6%	11.8%	6.4%	7.7%	15.4%	0.0%	4.3%	11.1%
		SA	5.9%	5.9%	8.5%	3.8%	7.7%	0.0%	2.2%	0.0%
8	BMW disinfection can reduce the chance of contracting infection	SD	0.0%	0.0%	5.3%	7.7%	0.0%	0.0%	4.3%	0.0%
		D	17.6%	0.0%	5.3%	0.0%	0.0%	0.0%	4.3%	0.0%
		N	23.5%	23.5%	9.6%	7.7%	38.5%	15.4%	4.3%	5.6%
		A	35.3%	52.9%	41.5%	26.9%	46.2%	46.2%	52.2%	55.6%
		SA	23.5%	23.5%	38.3%	57.7%	15.4%	38.5%	34.8%	38.9%
9	Wearing PPE helps to reduce risk of infection	SD	5.9%	0.0%	3.2%	0.0%	7.7%	7.7%	4.3%	0.0%
		D	0.0%	0.0%	2.1%	3.8%	0.0%	0.0%	2.2%	5.6%
		N	0.0%	5.9%	3.2%	3.8%	0.0%	0.0%	0.0%	0.0%
		A	41.2%	41.2%	33.0%	23.1%	38.5%	46.2%	28.3%	27.8%
		SA	52.9%	52.9%	58.5%	69.2%	53.8%	46.2%	65.2%	66.7%

Table17: Job category and variables that measure attitude at Zewditu hospital

No	Variable	Catg	Job category					
			Medical Doctor	Nurse	Midwife	Lab. tech.	Health officer	cleaner
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	Improperly managed health care wastes may cause infection	SD	4.3%	4.1%	0.0%	0.0%	7.7%	0.0%
		D	0.0%	8.2%	0.0%	0.0%	7.7%	4.8%
		N	4.3%	4.1%	0.0%	5.9%	0.0%	19.0%
		A	26.1%	30.1%	0.0%	29.4%	30.8%	47.6%
		SA	65.2%	53.4%	100.0%	64.7%	53.8%	28.6%
2	HIV may be transmitted through BMW	SD	4.3%	8.2%	0.0%	0.0%	7.7%	0.0%
		D	0.0%	2.7%	0.0%	0.0%	0.0%	0.0%
		N	8.7%	6.8%	0.0%	11.8%	15.4%	14.3%
		A	34.8%	31.5%	14.3%	23.5%	23.1%	38.1%
		SA	52.2%	50.7%	85.7%	64.7%	53.8%	47.6%
3	Hepatitis B virus	SD	4.3%	5.6%	0.0%	0.0%	0.0%	0.0%

	may be transmitted through BMW	D	0.0%	0.0%	0.0%	0.0%	7.7%	0.0%
		N	4.3%	6.9%	0.0%	11.8%	7.7%	19.0%
		A	26.1%	36.1%	28.6%	29.4%	23.1%	33.3%
		SA	65.2%	51.4%	71.4%	58.8%	61.5%	47.6%
4	Hepatitis C virus may be transmitted through BMW	SD	8.7%	1.4%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	9.7%	0.0%	0.0%	7.7%	9.5%
		N	4.3%	6.9%	0.0%	11.8%	23.1%	14.3%
		A	34.8%	36.1%	42.9%	29.4%	38.5%	33.3%
		SA	52.2%	45.8%	57.1%	58.8%	30.8%	42.9%
5	BMW do not transmit any infectious diseases	SD	82.6%	64.3%	100.0%	70.6%	30.8%	23.8%
		D	8.7%	20.0%	0.0%	17.6%	23.1%	33.3%
		N	0.0%	5.7%	0.0%	5.9%	7.7%	19.0%
		A	4.3%	10.0%	0.0%	5.9%	15.4%	9.5%
		SA	4.3%	0.0%	0.0%	0.0%	23.1%	14.3%
6	BMW should be segregate into different categories at the point of generation	SD	8.7%	4.1%	0.0%	5.9%	0.0%	0.0%
		D	0.0%	4.1%	0.0%	5.9%	0.0%	4.8%
		N	0.0%	9.6%	0.0%	0.0%	7.7%	14.3%
		A	21.7%	32.9%	28.6%	41.2%	23.1%	42.9%
		SA	69.6%	49.3%	71.4%	47.1%	69.2%	38.1%
7	Labeling of BMW containers does not add value on BMWM	SD	87.0%	53.4%	85.7%	47.1%	46.2%	23.8%
		D	4.3%	17.8%	0.0%	23.5%	30.8%	28.6%
		N	4.3%	11.0%	14.3%	11.8%	7.7%	23.8%
		A	0.0%	9.6%	0.0%	11.8%	7.7%	14.3%
		SA	4.3%	8.2%	0.0%	5.9%	7.7%	9.5%
8	BMW disinfection can reduce the chance of contracting infection	SD	4.3%	5.5%	14.3%	5.9%	0.0%	0.0%
		D	0.0%	4.1%	0.0%	5.9%	7.7%	14.3%
		N	8.7%	12.3%	0.0%	23.5%	0.0%	19.0%
		A	26.1%	43.8%	71.4%	23.5%	38.5%	42.9%
		SA	60.9%	34.2%	14.3%	41.2%	53.8%	23.8%
9	Wearing PPE helps to reduce risk of infection	SD	4.3%	2.7%	0.0%	0.0%	0.0%	4.8%
		D	0.0%	2.7%	0.0%	5.9%	0.0%	0.0%
		N	4.3%	2.7%	0.0%	11.8%	0.0%	0.0%
		A	21.7%	39.7%	28.6%	0.0%	46.2%	42.9%
		SA	69.6%	52.1%	71.4%	82.4%	53.8%	52.4%

Table18: Job category and variables that measure attitude at MCM hospital

No	Variable	Catg	Job category					
			Medical Doctor	Nurse	Midwife	Lab. tech.	Health officer	cleaner
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	Improperly managed health care wastes may cause infection	SD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		N	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		A	46.2%	69.6%	46.2%	30.8%	66.7%	68.8%
		SA	53.8%	30.4%	53.8%	69.2%	33.3%	31.3%
2	HIV may be transmitted through BMW	SD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		N	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%
		A	53.8%	69.6%	38.5%	38.5%	58.3%	60.0%
		SA	38.5%	30.4%	61.5%	61.5%	41.7%	40.0%
3	Hepatitis B virus may be transmitted through BMW	SD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	0.0%	0.0%	0.0%	0.0%	12.5%
		N	7.7%	4.3%	0.0%	0.0%	0.0%	37.5%
		A	53.8%	65.2%	46.2%	38.5%	66.7%	43.8%
		SA	38.5%	30.4%	53.8%	61.5%	33.3%	6.3%
4	Hepatitis C virus may be transmitted through BMW	SD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	0.0%	0.0%	0.0%	0.0%	12.5%
		N	7.7%	4.3%	0.0%	0.0%	0.0%	37.5%
		A	53.8%	56.5%	46.2%	38.5%	63.6%	43.8%
		SA	38.5%	39.1%	53.8%	61.5%	36.4%	6.3%
5	BMW do not transmit any infectious diseases	SD	53.8%	34.8%	69.2%	46.2%	36.4%	13.3%
		D	46.2%	60.9%	30.8%	46.2%	63.6%	80.0%
		N	0.0%	4.3%	0.0%	7.7%	0.0%	0.0%
		A	0.0%	0.0%	0.0%	0.0%	0.0%	6.7%
		SA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	BMW should be segregate into different categories at the point of generation	SD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		D	0.0%	0.0%	0.0%	0.0%	0.0%	6.3%
		N	0.0%	8.7%	0.0%	7.7%	0.0%	0.0%
		A	69.2%	69.6%	53.8%	38.5%	58.3%	68.8%
		SA	30.8%	21.7%	46.2%	53.8%	41.7%	25.0%
7	Labeling of BMW containers does not add value on BMWM	SD	15.4%	21.7%	53.8%	30.8%	25.0%	12.5%
		D	69.2%	65.2%	46.2%	61.5%	58.3%	37.5%
		N	7.7%	8.7%	0.0%	0.0%	0.0%	31.3%
		A	0.0%	4.3%	0.0%	7.7%	16.7%	12.5%
		SA	7.7%	0.0%	0.0%	0.0%	0.0%	6.3%
8	BMW	SD	0.0%	4.3%	0.0%	7.7%	0.0%	0.0%

	disinfection can reduce the chance of contracting infection	D	0.0%	4.3%	0.0%	7.7%	0.0%	0.0%
		N	7.7%	13.0%	0.0%	0.0%	8.3%	31.3%
		A	61.5%	47.8%	53.8%	38.5%	58.3%	50.0%
		SA	30.8%	30.4%	46.2%	46.2%	33.3%	18.8%
9	Wearing PPE helps to reduce risk of infection	SD	0.0%	0.0%	0.0%	15.4%	0.0%	12.5%
		D	0.0%	4.3%	0.0%	0.0%	8.3%	0.0%
		N	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		A	30.8%	39.1%	30.8%	23.1%	33.3%	31.3%
		SA	69.2%	56.5%	69.2%	61.5%	58.3%	56.3%

Table 20: Training and variables that measure attitude

No.	Variable	cat.	hospital type							
			Zewditu				MCM			
			Having training				Having training			
			No		Yes		No		Yes	
			N	C.V. N %	N	C.V .N %	N	C.V .N %	N	C.V .N %
1	Improperly managed health care wastes may cause infection	SD	2	2.4%	3	4.2%	0	0.0%	0	0.0%
		D	5	6.0%	3	4.2%	0	0.0%	0	0.0%
		N	6	7.2%	3	4.2%	0	0.0%	0	0.0%
		A	27	32.5%	20	28.2%	36	61.0%	15	48.4%
		SA	43	51.8%	42	59.2%	23	39.0%	16	51.6%
2	HIV may be transmitted through BMW	SD	3	3.6%	5	7.0%	0	0.0%	0	0.0%
		D	1	1.2%	1	1.4%	0	0.0%	0	0.0%
		N	7	8.4%	7	9.9%	1	1.7%	0	0.0%
		A	28	33.7%	19	26.8%	33	56.9%	16	51.6%
		SA	44	53.0%	39	54.9%	24	41.4%	15	48.4%
3	Hepatitis B virus may be transmitted through BMW	SD	4	4.8%	1	1.4%	0	0.0%	0	0.0%
		D	0	0.0%	1	1.4%	2	3.4%	0	0.0%
		N	7	8.4%	6	8.6%	6	10.2%	2	6.5%
		A	27	32.5%	22	31.4%	32	54.2%	16	51.6%
		SA	45	54.2%	40	57.1%	19	32.2%	13	41.9%
4	Hepatitis C virus may be transmitted through BMW	SD	3	3.6%	0	0.0%	0	0.0%	0	0.0%
		D	7	8.4%	3	4.3%	2	3.4%	0	0.0%
		N	8	9.6%	6	8.6%	5	8.6%	3	9.7%
		A	30	36.1%	24	34.3%	30	51.7%	15	48.4%
		SA	35	42.2%	37	52.9%	21	36.2%	13	41.9%
5	BMW do not transmit any infectious diseases	SD	45	54.9%	47	68.1%	21	36.8%	15	48.4%
		D	17	20.7%	12	17.4%	34	59.6%	15	48.4%
		N	7	8.5%	3	4.3%	2	3.5%	0	0.0%
		A	8	9.8%	5	7.2%	0	0.0%	1	3.2%

		SA	5	6.1%	2	2.9%	0	0.0%	0	0.0%
6	BMW should be segregate into different categories at the point of generation	SD	2	2.4%	4	5.6%	0	0.0%	0	0.0%
		D	4	4.8%	1	1.4%	0	0.0%	1	3.2%
		N	6	7.2%	5	7.0%	3	5.1%	0	0.0%
		A	29	34.9%	21	29.6%	37	62.7%	18	58.1%
		SA	42	50.6%	40	56.3%	19	32.2%	12	38.7%
7	Labeling of BMW containers does not add value on BMWM	SD	45	54.2%	39	54.9%	13	22.0%	10	32.3%
		D	15	18.1%	13	18.3%	34	57.6%	17	54.8%
		N	9	10.8%	9	12.7%	7	11.9%	1	3.2%
		A	8	9.6%	5	7.0%	4	6.8%	2	6.5%
		SA	6	7.2%	5	7.0%	1	1.7%	1	3.2%
8	BMW disinfection can reduce the chance of contracting infection	SD	4	4.8%	3	4.2%	2	3.4%	0	0.0%
		D	5	6.0%	3	4.2%	2	3.4%	0	0.0%
		N	9	10.8%	10	14.1%	9	15.3%	1	3.2%
		A	32	38.6%	29	40.8%	28	47.5%	18	58.1%
		SA	33	39.8%	26	36.6%	18	30.5%	12	38.7%
9	Wearing PPE helps to reduce risk of infection	SD	2	2.4%	2	2.8%	4	6.8%	0	0.0%
		D	1	1.2%	2	2.8%	2	3.4%	0	0.0%
		N	2	2.4%	3	4.2%	0	0.0%	0	0.0%
		A	28	33.7%	23	32.4%	20	33.9%	9	29.0%
		SA	50	60.2%	41	57.7%	33	55.9%	22	71.0%

Table22: Presence of guideline and variables that measure attitude

No.	Variable	cat.	Hospital type					
			Zewditu			MCM		
			Presence of guideline			Presence of guideline		
			No	Not sure	Yes	NO	No sure	yes
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	Improperly managed health care wastes may cause infection	SD	0.00%	3.10%	5.20%	0.00%	0.00%	0.00%
		D	9.40%	4.70%	3.40%	0.00%	0.00%	0.00%
		N	6.30%	9.40%	1.70%	0.00%	0.00%	0.00%
		A	40.60%	37.50%	17.20%	55.00%	67.60%	47.20%
		SA	43.80%	45.30%	72.40%	45.00%	32.40%	52.80%
2	HIV may be transmitted through BMW	SD	3.10%	1.60%	10.30%	0.00%	0.00%	0.00%
		D	3.10%	0.00%	1.70%	0.00%	0.00%	0.00%
		N	9.40%	10.90%	6.90%	0.00%	3.00%	0.00%

		A	37.50%	43.80%	12.10%	50.00%	66.70%	47.20%
		SA	46.90%	43.80%	69.00%	50.00%	30.30%	52.80%
3	Hepatitis B virus may be transmitted through BMW	SD	3.10%	3.10%	3.50%	0.00%	0.00%	0.00%
		D	0.00%	1.60%	0.00%	0.00%	2.90%	2.80%
		N	9.40%	10.90%	5.30%	0.00%	11.80%	11.10%
		A	46.90%	29.70%	26.30%	50.00%	61.80%	47.20%
		SA	40.60%	54.70%	64.90%	50.00%	23.50%	38.90%
4	Hepatitis C virus may be transmitted through BMW	SD	0.00%	1.60%	3.40%	0.00%	0.00%	0.00%
		D	9.40%	6.30%	5.20%	0.00%	3.00%	2.80%
		N	15.60%	11.10%	3.40%	0.00%	15.20%	8.30%
		A	40.60%	33.30%	34.50%	50.00%	51.50%	50.00%
		SA	34.40%	47.60%	53.40%	50.00%	30.30%	38.90%
5	BMW do not transmit any infectious diseases	SD	51.60%	51.60%	75.90%	40.00%	37.50%	44.40%
		D	25.80%	19.40%	15.50%	60.00%	56.30%	52.80%
		N	12.90%	8.10%	1.70%	0.00%	3.10%	2.80%
		A	3.20%	14.50%	5.20%	0.00%	3.10%	0.00%
		SA	6.50%	6.50%	1.70%	0.00%	0.00%	0.00%
6	BMW should be segregate into different categories at the point of generation	SD	6.30%	4.70%	1.70%	0.00%	0.00%	0.00%
		D	6.30%	4.70%	0.00%	0.00%	0.00%	2.80%
		N	12.50%	6.30%	5.20%	0.00%	5.90%	2.80%
		A	31.30%	34.40%	31.00%	55.00%	73.50%	52.80%
		SA	43.80%	50.00%	62.10%	45.00%	20.60%	41.70%
7	Labeling of BMW containers does not add value on BMWM	SD	56.30%	48.40%	60.30%	20.00%	20.60%	33.30%
		D	18.80%	21.90%	13.80%	75.00%	55.90%	47.20%
		N	9.40%	14.10%	10.30%	5.00%	11.80%	8.30%
		A	12.50%	7.80%	6.90%	0.00%	8.80%	8.30%
		SA	3.10%	7.80%	8.60%	0.00%	2.90%	2.80%
8	BMW disinfection can	SD	6.30%	1.60%	6.90%	5.00%	2.90%	0.00%

	reduce the chance of contracting infection	D	12.50%	6.30%	0.00%	5.00%	0.00%	2.80%
		N	12.50%	15.60%	8.60%	5.00%	17.60%	8.30%
		A	40.60%	40.60%	37.90%	45.00%	52.90%	52.80%
		SA	28.10%	35.90%	46.60%	40.00%	26.50%	36.10%
9	Wearing PPE helps to reduce risk of infection	SD	3.10%	3.10%	1.70%	5.00%	2.90%	5.60%
		D	0.00%	3.10%	1.70%	10.00%	0.00%	0.00%
		N	3.10%	4.70%	1.70%	0.00%	0.00%	0.00%
		A	37.50%	39.10%	24.10%	35.00%	35.30%	27.80%
		SA	56.30%	50.00%	70.70%	50.00%	61.80%	66.70%

PRACTICE

Table25: Gender and variables that measure practice

No.	Variables	Catg	hospital type							
			Zewditu				MCM			
			Gender		Gender					
			Male		Female		Male		Female	
			N	Col.Val. N%	N	Col.Val .N%	N	Col.Val.N%	N	Col.Val. N%
1	Do you label BMW container?	No	11	21.6%	42	41.2%	15	46.9%	33	56.9%
		Yes	40	78.4%	60	58.8%	17	53.1%	25	43.1%
2	Do you segregate BMW at generation?	No	13	25.5%	32	32.0%	1	3.1%	9	15.5%
		Yes	38	74.5%	68	68.0%	31	96.9%	49	84.5%
3	Do you follow colour coding segregation?	No	7	17.9%	16	21.6%	2	6.5%	5	10.0%
		Yes	32	82.1%	58	78.4%	29	93.5%	45	90.0%
4	Do you use gloves while you are handling BMWs?	No	1	2.0%	4	3.9%	0	0.0%	0	0.0%
		Yes	50	98.0%	98	96.1%	32	100.0%	58	100.0%
5	Do you wear gown while you are handling BMWs?	No	2	3.9%	2	2.0%	0	0.0%	0	0.0%
		Yes	49	96.1%	100	98.0%	32	100.0%	58	100.0%
6	Do you put non-infectious wastes in black bin?	No	19	37.3%	35	34.3%	9	28.1%	22	37.9%
		Yes	32	62.7%	67	65.7%	23	71.9%	36	62.1%
7	Do you put infectious wastes in yellow bin?	No	15	29.4%	29	28.4%	9	28.1%	22	37.9%
		Yes	36	70.6%	73	71.6%	23	71.9%	36	62.1%
8	Do you put sharp wastes in safety box?	No	6	11.8%	14	13.7%	0	0.0%	1	1.7%
		Yes	45	88.2%	88	86.3%	32	100.0%	57	98.3%

Table27: Educational level and variables that measure practice panel by hospital type

No.	Variables	Catg	Hospital Type							
			Zewditu				MCM			
			Educational level				Educational level			
			< dipl.	Dipl.	First deg.	Mas.and above	< dipl.	Dipl.	First deg.	Mas.and above
			Col. Val.N %	Col. Val.N %	Col. Val.N %	Col. Val.N%	Col. Val.N%	Col. Val.N%	Col. Val.N%	Col. Val.N%
1.	Do you label BMW?	No	64.7%	29.4%	33.0%	23.1%	100.0%	30.8%	47.8%	50.0%
		Yes	35.3%	70.6%	67.0%	76.9%	0.0%	69.2%	52.2%	50.0%
2.	Do you segregate?	No	47.1%	35.3%	23.9%	34.6%	38.5%	23.1%	2.2%	5.6%
		Yes	52.9%	64.7%	76.1%	65.4%	61.5%	76.9%	97.8%	94.4%
3.	Do you follow colour coding?	No	44.4%	27.3%	16.2%	20.0%	22.2%	18.2%	4.5%	5.9%
		Yes	55.6%	72.7%	83.8%	80.0%	77.8%	81.8%	95.5%	94.1%
4.	Do you use gloves?	No	5.9%	5.9%	3.2%	3.8%	0.0%	0.0%	0.0%	0.0%
		Yes	94.1%	94.1%	96.8%	96.2%	100.0%	100.0%	100.0%	100.0%
5.	Do you wear gown?	No	5.9%	11.8%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%
		Yes	94.1%	88.2%	97.9%	100.0%	100.0%	100.0%	100.0%	100.0%
6.	Non-infectious to black bin?	No	41.2%	47.1%	31.9%	34.6%	61.5%	23.1%	32.6%	27.8%
		Yes	58.8%	52.9%	68.1%	65.4%	38.5%	76.9%	67.4%	72.2%
7.	Infectious wastes to yellow bin?	No	35.3%	5.9%	27.7%	42.3%	61.5%	23.1%	32.6%	27.8%
		Yes	64.7%	94.1%	72.3%	57.7%	38.5%	76.9%	67.4%	72.2%
8.	Sharp wastes to safety box?	No	5.9%	23.5%	12.8%	11.5%	7.7%	0.0%	0.0%	0.0%
		Yes	94.1%	76.5%	87.2%	88.5%	92.3%	100.0%	100.0%	100.0%

Table29: Job category and variables that measure practice at zewditu hospital

No.	Variable	Catg.	Med. Doc	Nurse	Mid wife	Lab. Tech	HO	Cleaner
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	Do you label BMW container?	No	43.5%	28.8%	28.6%	23.5%	30.8%	57.1%
		Yes	56.5%	71.2%	71.4%	76.5%	69.2%	42.9%
2	Do you segregate BMW at generation?	No	30.4%	30.6%	14.3%	5.9%	25.0%	52.4%
		Yes	69.6%	69.4%	85.7%	94.1%	75.0%	47.6%
3	Do you follow colour coding segregation?	No	11.1%	22.6%	0.0%	11.8%	30.0%	40.0%
		Yes	88.9%	77.4%	100.0%	88.2%	70.0%	60.0%

4	Do you use gloves while you are handling BMWs?	No	0.0%	5.5%	0.0%	5.9%	0.0%	4.8%
		Yes	100.0%	94.5%	100.0%	94.1%	100.0%	95.2%
5	Do you wear gown while you are handling BMWs?	No	0.0%	4.1%	0.0%	5.9%	0.0%	4.8%
		Yes	100.0%	95.9%	100.0%	94.1%	100.0%	95.2%
6	Do you put non-infectious wastes in black bin?	No	43.5%	27.4%	14.3%	41.2%	53.8%	42.9%
		Yes	56.5%	72.6%	85.7%	58.8%	46.2%	57.1%
7	Do you put infectious wastes in yellow bin?	No	30.4%	26.0%	28.6%	23.5%	46.2%	28.6%
		Yes	69.6%	74.0%	71.4%	76.5%	53.8%	71.4%
8	Do you put sharp wastes in safety box?	No	8.7%	15.1%	0.0%	23.5%	15.4%	4.8%
		Yes	91.3%	84.9%	100.0%	76.5%	84.6%	95.2%

Table30: Association of job category and variables that measure practice at MCM hospital

No.	Variable	Catg.	Med. Doc	Nurse	Mid wife	Lab. Tech	HO	Cleaner
			C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %	C.V. N %
1	Do you label BMW container?	No	84.6%	52.2%	23.1%	7.7%	50.0%	93.8%
		Yes	15.4%	47.8%	76.9%	92.3%	50.0%	6.3%
2	Do you segregate BMW at generation?	No	15.4%	4.3%	0.0%	0.0%	0.0%	43.8%
		Yes	84.6%	95.7%	100.0%	100.0%	100.0%	56.3%
3	Do you follow colour coding segregation?	No	18.2%	13.6%	0.0%	0.0%	0.0%	20.0%
		Yes	81.8%	86.4%	100.0%	100.0%	100.0%	80.0%
4	Do you use gloves while you are handling BMWs?	No	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
5	Do you wear gown while you are handling BMWs?	No	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Yes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
6	Do you put non-infectious wastes in black bin?	No	38.5%	34.8%	30.8%	23.1%	16.7%	56.3%
		Yes	61.5%	65.2%	69.2%	76.9%	83.3%	43.8%

7	Do you put infectious wastes in yellow bin?	No	38.5%	34.8%	30.8%	23.1%	16.7%	56.3%
		Yes	61.5%	65.2%	69.2%	76.9%	83.3%	43.8%
8	Do you put sharp wastes in safety box?	No	0.0%	0.0%	0.0%	0.0%	0.0%	6.3%
		Yes	100.0%	100.0%	100.0%	100.0%	100.0%	93.8%

Table32: Training and variables that measure practice panel by hospital type

No.	Variables	Catg.	Hospital type							
			Zewditu				MCM			
			Having training				Having training			
			No		Yes		No		Yes	
			N	C.V.N %	N	C.V.N %	N	C.V.N %	N	C.V.N %
1.	Do you label BMW container?	No	38	45.8%	15	21.1%	38	64.4%	10	32.3%
		Yes	45	54.2%	56	78.9%	21	35.6%	21	67.7%
2.	Do you segregate BMW at generation?	No	26	32.1%	19	26.8%	9	15.3%	1	3.2%
		Yes	55	67.9%	52	73.2%	50	84.7%	30	96.8%
3.	Do you follow colour coding segregation?	No	16	25.4%	7	13.7%	4	7.8%	3	10.0%
		Yes	47	74.6%	44	86.3%	47	92.2%	27	90.0%
4.	Do you use gloves while you are handling BMWs?	No	3	3.6%	3	4.2%	0	0.0%	0	0.0%
		Yes	80	96.4%	68	95.8%	59	100.0%	31	100.0%
5.	Do you wear gown while you are handling BMWs?	No	3	3.6%	2	2.8%	0	0.0%	0	0.0%
		Yes	80	96.4%	69	97.2%	59	100.0%	31	100.0%
6.	Do you put non-infectious wastes in black bin?	No	32	38.6%	22	31.0%	23	39.0%	8	25.8%
		Yes	51	61.4%	49	69.0%	36	61.0%	23	74.2%
7.	Do you put infectious wastes in yellow bin?	No	25	30.1%	19	26.8%	23	39.0%	8	25.8%
		Yes	58	69.9%	52	73.2%	36	61.0%	23	74.2%
8.	Do you put sharp wastes in safety box?	No	9	10.8%	11	15.5%	1	1.7%	0	0.0%
		Yes	74	89.2%	60	84.5%	58	98.3%	31	100.0%

Table34: Presence of guideline and variables that measure practice panel by hospital type

No.	Variables	Catg..	Hospital type					
			Zewditu			MCM		
			Presence of guideline			Presence of guideline		
			No	Not sure	Yes	No	Not sure	Yes
			C.V.N%	C.V.N%	C.V.N%	C.V.N%	C.V.N%	C.V.N%
1.	Do you label BMW container?	No	46.9%	51.6%	8.6%	60.0%	76.5%	27.8%
		Yes	53.1%	48.4%	91.4%	40.0%	23.5%	72.2%
2.	Do you segregate BMW at generation?	No	38.7%	33.3%	20.7%	5.0%	14.7%	11.1%
		Yes	61.3%	66.7%	79.3%	95.0%	85.3%	88.9%

3.	Do you follow colour coding segregation?	No	15.0%	31.9%	10.6%	15.8%	10.0%	3.1%
		Yes	85.0%	68.1%	89.4%	84.2%	90.0%	96.9%
4.	Do you use gloves while you are handling BMWs?	No	9.4%	3.1%	1.7%	0.0%	0.0%	0.0%
		Yes	90.6%	96.9%	98.3%	100.0%	100.0%	100.0%
5.	Do you wear gown while you are handling BMWs?	No	6.3%	1.6%	3.4%	0.0%	0.0%	0.0%
		Yes	93.8%	98.4%	96.6%	100.0%	100.0%	100.0%
6.	Do you put non-infectious wastes in black bin?	No	34.4%	35.9%	34.5%	25.0%	38.2%	36.1%
		Yes	65.6%	64.1%	65.5%	75.0%	61.8%	63.9%
7.	Do you put infectious wastes in yellow bin?	No	31.3%	23.4%	32.8%	25.0%	38.2%	36.1%
		Yes	68.8%	76.6%	67.2%	75.0%	61.8%	63.9%
8.	Do you put sharp wastes in safety box?	No	12.5%	20.3%	5.2%	0.0%	2.9%	0.0%
		Yes	87.5%	79.7%	94.8%	100.0%	97.1%	100.0%

Table37: Table Association of practice and healthcare facility factors

No.	Healthcare facility factors		Practice
1.	Availability of visual aid/ instruction near the waste receptacles	Pearson Correlation	.245**
		Sig. (2-tailed)	.001
		N	172
2.	Availability of sufficient gloves in the department	Pearson Correlation	.262**
		Sig. (2-tailed)	.000
		N	173
3.	Availability of all 3 bins (black bin, yellow bin and safety box) in your department/ section	Pearson Correlation	.186**
		Sig. (2-tailed)	.010
		N	192

Table38: Pearson's Correlation of Knowledge, Attitude, and Practice

		Knowledge	**Attitude**	**Practice**
Knowledge	Pearson Correlation	1	.261**	.517**
	Sig. (2-tailed)		.000	.000
	N	242	235	193
Attitude	Pearson Correlation	.261**	1	.136
	Sig. (2-tailed)	.000		.060
	N	235	237	191
Practice	Pearson Correlation	.517**	.136	1
	Sig. (2-tailed)	.000	.060	
	N	193	191	193
**. Correlation is significant at the 0.01 level (2-tailed).				

Annex 2: Questionnaire

Annex II English Version Questionnaire

1. **Information sheet:**

Title of the research:

Assessment of knowledge, attitude and practices of healthcare workers towards hospital waste management: a comparative study of public and private hospitals in Addis Ababa

Principal investigator: Seble Lemma (A post graduate student in General management)

Ethical review approval: The approval to carry out this study was given by ethical review committee of department of medical laboratory sciences, Addis Ababa University.

Objective: The objective of this study is to assess and compare knowledge, attitude and practice about biomedical waste management and associated factorsamonghealthcare workers at Zewditu Memorial hospital and Koriyawoch (MCM) hospital.

Perceived benefits and risk: The result may benefit clients, health care worker, health care facility managers, researchers, policy makers and other stakeholders as appropriate. Being involved in this study does not induce any risk.

Persons to contact: Seble Lemma

Phone: +251911312575

Email: mysaffron2008@yahoo.com

2. **Consent form:**

Dear participant! You are among the study participants selected from the health care workers in the facility. It is your full right to participate in this study but if you are not willing to take part you can leave the questionnaire empty however; your honest answers to these questions will help me to get important data on biomedical waste management and associated factors, so; you are kindly requested to give your honest responses and keep participating. It will take a maximum of 8 minutes to answer these questions.

Confidentiality: All personal identifiers and personal information will not be taken hence your responses will be kept confidential. Data will be accessed by the principal investigator; advisors and research assistant only and finally will be analyzed anonymously. Hence, please do not write your name or other personal identifier on the questionnaire! Would you willing to participate please? If your answer is yes, encircle 2 and go to the next part.

1. No 2. Yes

3. Questionnaire and observational checklist for HCWs

Please read the instruction and questions for each section before you answer, if you have unclear question or instruction you can ask the principal investigator or assistant.

Date ----------

Health Care Facility Identification Code ____

Study Participant Identification Code _____

Section 1: Socio-demographic and health care related profile

Please encircle your choice code among the given alternatives.

No.	Socio Demographic Variables	Answer
1.1	Sex?	1. Male 2. Female
1.2	Age in full years?	_____years
1.3	What is your level of education?	1. Diploma 2. First Degree 3. MSc and above
1.4	What is your job category?	1. Medical doctor 2. Nurse 3. Midwifery 4. Medical laboratory 5. Health officer
1.5	How much is your work experience as a health care professional?	_____Years
1.6	Where do you get information about biomedical waste management? **(More than one answers are possible)**	1. Guide line 2. Training 3. Friends 4. Others (specify)_____
1.7	Have you ever taken training on biomedical waste management or related issues?	1. No 2. Yes
1.7	Have you taken vaccine for hepatitis B virus?	1. No 2. Yes
1.8	Are there any guideline /operational document for biomedical waste management or infection prevention in your department/ section?	1. No 2. Not sure 3. Yes

Section 2: Questions to assess knowledge of health care professionals and cleaners about biomedical waste management and associated factors at health care facilities.

Please encircle your choice code among the possible alternatives for the questions given below in the table.

No.	Questions to assess health care professionals' knowledge	Answer	
		1. No	2. Yes
2.1	Do you now about biomedical waste management?		
2.2	Is there any health hazard associated with biomedical wastes?		
2.3	Is needle-stick or sharp injury a concern?		
2.4	Does wearing personal protective equipment reduce risk of infection?		
2.5	Do you know about colour coding segregation of biomedical wastes?		
2.6	Should infectiously waste containers be labelled with biohazard symbol?		
2.7	Should biomedical wastes be segregated into different categories at the point of generation?		

2.8. Which of the following is internationally accepted symbol for biohazard?

1.  2.  3.  4. 

2.9. What type of biomedical waste should be disposed in a yellow biomedical waste disposal bin?

1. General waste 2. Infectious waste 3. I don't know

2.10. What type of biomedical waste should be disposed in a black biomedical waste disposal bin?

1. General waste 2. Infectious waste 3. I don't know

2.11. Where should medical supplies capable of causing puncture or cut be disposed?

1. Black bin 2. Yellow bin 3. Safety box 4. I don't know

2.12. How maximum full should be the safety box containing sharp medical supplies?

1. ½full 2. 3/4 full 3. Full 4. I don't know

2.13. According to World Health Organization guideline, what is the maximum delay to start HIV post-exposure prophylaxis?

1. 24 hours 2. 48 hours 3. 72 hours 4. I don't know

Section 3:

Questions to assess attitude of health care professionals and cleaners about biomedical waste management and associated factors at health care facilities.

Please read each statement and select your answer from the right margin of the following table based on the following scale of measurement (1-5):

1=StronglyDisagree (SD); 2=Disagree(D); 3=Neutral (N); 4=Agree (A); 5=Strongly Agree (SA)

No.	What is your opinion/belief on the following statements?	SD	D	N	A	SA
3.1	Improperly managed health care wastes may cause infection					
3.2	HIV may be transmitted through biomedical wastes					
3.3	HIV post exposure prophylaxis will help to prevent development of HIV infection					
3.4	Hepatitis B virus may be transmitted through biomedical wastes					
3.5	Hepatitis C virus may be transmitted through biomedical wastes					
3.6	Biomedical wastes do not transmit any infectious diseases					
3.7	Biomedical wastes should be segregate into different categories at the point of generation					
3.8	Labelling of biomedical waste containers does not add value on biomedical waste management					
3.9	Biomedical waste disinfection can reduce the chance of contracting infection					
3.10	Wearing personal protective equipment helps to reduce risk of infection					

Section 4: Questions to assess practice of health care professionals and cleaners about biomedical waste management and associated factors at health care facilities.

Please encircle your choice among the possible alternatives given the table below. Please use the following description for the terms given in the question.

Keys:

For question 4.3 sufficient means availability of enough glove for 1-day consumption and for question 4.8 and 4.9 'always' means use of the indicated personal protective equipment continuously while it is necessary, 'sometimes' means when you use occasionally while it is necessary and 'never' means when you don't use the indicated personal protective equipment at all times while it is necessary.

No.	Variables	Response		Remark
4.1.	Have you ever encountered any sharp /needle stick injury in the last 12 months?	1.No	2.Yes	
4.2.	Are there visual aid/ instruction present near the waste receptacles?	1.No	2.Yes	
4.3.	Are gloves available in sufficient quantity in your facility?	1.No	2.Yes	
4.4.	Do you label biomedical waste containers?	1.No	2.Yes	
4.5.	Are all 3 bins (black bin, yellow bin and safety box) available in your department/ section?	1.No	2.Yes	
4.6.	Do you segregate biomedical wastes according to their type at the point of generation?	1.No	2.Yes	
4.7.	If yes on question 4.6, do you follow colour coding segregation?	1.No	2.Yes	If **No** stop
4.8.	How often do you use gloves while you are working with/handling of biomedical wastes?	1. Never 2. Sometimes 3. Always		
4.9	How often do you wear gown while you are working with/handling of biomedical wastes?	1. Never 2. Sometimes 3. Always		

4.10. Where do you put non-infectious wastes like paper, plastic and other supplies?

1. Black waste bin 2.Yellow waste bin 3.Other (specify)_____

4.11. Where do you put infectiouswastes like cotton, gauze and other items contaminated with blood and body fluids?

1. Black waste bin 2.Yellow waste bin 3.Other (specify)_____

4.12. Where do you put sharp waste medical supplies which may cause punctures or cuts?

1. Safety box 2.Black plastic bin 3.Yellow plastic bin 4.Other (specify)_____

Dear Participant Thank You for Your Cooperation!

Date ----------

Health Care Facility Identification Code ____

Study Participant Identification Code _____

Section 5:

Health care professionals' practice observation checklist

Data collector should observe actual practices of health care professionals and tick the appropriate alternative code in the table given below

No.	Activities to be observed	Answer		Remark
		No	Yes	
5.1	Are there visual aid/ instruction present near the waste receptacles?			
5.2	Are gloves available in sufficient quantity?			
5.3	Does he/she use gloves while handling/ working with biomedical wastes?			
5.4	Does he/she wear gown while handling/ working with biomedical wastes?			
5.5	Is there yellow bio-hazardouswaste disposal bin in the section?			**If No go to 5.7**
5.6	If yes does it contain only infectious waste?			
5.7	Is there black biomedicalwaste disposal bin in the section?			**If No go to 5.9**
5.8	If yes does it contain only non-infectious waste?			
5.9	Is there a biohazard symbol labelled safety box in the section?			
5.10	Does he/she segregate biomedical wastes according to their category?			
5.11	Are all available bins clearly labelled?			
5.12	Is there infectious waste container more than 3/4 full?			

Date ----------

Health Care Facility Identification Code ____

Study Participant Identification Code _____

Section 6 :Cleaners practice observation checklist

For the data collector: *Please observe the cleaner while she/he is on her/his duty. Read each question and encircle the answer from the right margin of the table*

No.	Variables	Response
6.1	Which personal protective equipment is available in your facility? **(More than one answers are possible)**	1. Heavy-duty gloves 2. Boots 3. Apron 4. None is available
6.2	Did she/he use heavy-duty gloves?	1. Yes 2. No
6.3	Did she/he use boots?	1. Yes 2. No
6.4	Did she/he wearapron?	1. Yes 2. No
6.5	Did she/he disinfect/decontaminate reusable cleaning devices after use?	1. Yes 2. No
6.6	Did she/he collect infectious biomedical wastes from service area within 24 hours?	1. Yes 2. No
6.7	Did she/he transport biomedical wastes separately?	1. Yes 2. No
6.8	What biomedical waste transporting equipment she/he use? (More than one answers are possible)	1. Trolley/wheelbarrow 2. Closed bucket 3. Open bucket 4. Other (specify)_____
6.9	Did she/he close biomedical waste containers during transport?	1. Yes 2. No

Date ----------
Health Care Facility Identification Code ____

Section 7: Health care facility observational check list

7.1. What BMW storage method the facility used?

1. Onsite storage room
2. Puncture resistant storage containers
3. Other specify

7.2. Is there infectious waste stored for more than two days?

1. Yes 2. No

7.3. Does the facility use onsite BMW treatment methods? (**If No go to 7.5)**

2. Yes 2. No

7.4. What BMW treatment method the facilityare used? **(Multiple answers are possible)**

1. Incineration
2. Sterilization
3. Chemical
4. Burning
5. Others(specify)_____

Annex II Amharic Version Questionnaires and Observational Checklists

1. የመረጃመስጫቅፅ:

የጥናቱርዕስ:

የሆስፒታልቆሻሻአወጋገድንእናተዛማጅተጽዕኖዎችንበተመለከተየጤናተቋምሰራተኞችንእውቀት፤አመለካከትእናተግባርበዘ ውዲቱጠቅላላሆስፒታልእናበኮሪያዎችሆስፒታልማነፃፀርነው::

እኔወ/ሮስብለለማእባላለሁ::በቅድስተማሪያምዩኒቨርሲቲየሁለተኛዲግሪየጀነራልማኔጅመንትተማሪስሆንይህየመመረቂያጥ ናታዊጽሁፍበአዲስአበባሄልዝሪሰርችኤንድኢመርጀንሲማኔጅመንትዲሬክቶሬትኢቲካልሪቪውኮሚቴታይቶእንዲፀድቅተደ ርጓል::

የጥናቱአላማ:

ከጤናተቋምየሚወጡቆሻሻዎችንአወጋገድናተዛማጅተጽዕኖዎችንበተመለከተየጤናተቋምሰራተኞችንእውቀት፤አመለካከትእ ናተግባርመገምገምነው::

በጥናቱየመሳተፍጥቅምናጉዳቱ:

የዚህጥናትውጤትለታካሚዎች፤ለጤናተቋምሰራተኞች፤ለጤናተቋምአስተዳዳሪዎች፤ተመራማሪዎችእንዲሁምለህግአርቃቂ ዎችእንደአስፈላጊነቱሊጠቅምይችላል::እርስዎበዚህጥናትበመሳተፍዎምንምአይነትስጋትሊኖርብዎአይገባም::

ሚስጥራዊነቱ:

በዚህጥናትእርስዎንሊገልፅየሚችልማንኛውምአይነትመረጃአይወሰድም፡፡እንዲሁምእርስዎየሰጡትመረጃከጥናቱተመራማ
ሪ፡አማካሪዎችናረዳቶችበስተቀርለማንምተላልፎአይሰጥም፡፡በመጨረሻምውጤቱአንደአጠቃላይሪፖርትይደረጋልእንጅየእ
ያንዳንዱሰውመረጃለብቻውአይገለፅም፡፡

በጥናቱስለመሳተፍናማቋረጥ: እርስዎበዚህ 8
ደቂቃለሚቆየውመጠይቅመሳተፍምሆነአለመሳተፍወይምደግሞጀምረውማቋረጥይችላሉ፡፡

ለተጨማሪመረጃ: ይህንንጥናትበተመለከተጥያቄወይምአስተያየትካለዎትየሚከተሉትንማግኘትይችላሉ፡፡

ተመራማሪው: ወ/ሮሰብለለማ (Mob: +251911312575, Email: mysaffron2008@yahoo.com)

አማካሪዎች: ዶ/ርብርሃኑእንደሻው (Email: berhanu22012@gmail.com)

2. የስምምነትማረጋገጫ:
ውድየጥናቱተሳታፊ!

እርስዎለዚህጥናትብቁከሆኑትመካከልአንዱነዎት፡፡በእርስዎበነፈቃድይህንንመጠይቅመሙላትከጤናተቋምየሚወጣቆሻሻ
አወጋገድንበተመለከተእጅግጠቃሚየሆኑመረጃዎችንስለሚያስገኝልኝይህንንመጠይቅእንዲሞሉልኝበትህትናእጠይቃለሁ፡፡

ስለዚህበዚህጥናትይሳተፋሉ? መልስዎአዎከሆነ 1 ቁጥርንያክቡናወደሚቀጥለውይለፉ፡፡

1. አዎ 2. ፈቃደኛአይደለሁም

3. መጠይቅ
ከፍል1: ማህበረሰባዊእናስነ- ህዝብጥያቄዎችወይምደግሞጤናተቋማዊነክጥያቄዎች

ቀን----------

የጤናተቋሙመለያቁጥር----------

የጥናቱተሳታፊመለያቁጥር----------

እባክዎትንእያንዳንዱንጥያቄእንብበውከተረዱበኋላለእርስዎተስማሚየሆነውንየመልስአማራጭክብ፡፡ግልፅያልሆነጥያ
ቄካለመረጃሰብሳቢውንወይምየጥናቱንባለቤትመጠየቅይችላሉ፡፡

ተ.ቁ	ማህበረሰባዊእናስነ-ህዝብጥያቄዎች	የመልስአማራጮች
1.1	ፆታ?	1. ወንድ 2. ሴት
1.2	እድሜዎስንትነው?	_____ ዓመት
1.3	የትምህርትደረጃዎ?	1. ዲፕሎማ 2. የመጀመሪያዲግሪ 3. ሁለተኛዲግሪናከዛበ ላይ

1.4	ሙያዎ/ የስራድርሻዎምንድንነው?	1. ዶክተር 2. ነርስ 3. ጽዳት 4. የላቦራቶሪባለሙያ 5. የፅዳትሰራተኛ
1.5	በሙያዎለምንያክልዓመትአገልግለዋል?	_____ዓመት
1.6	የጤናተቋምቆሻሻአወጋገድንበተመለከተመረጃከየትነውየሚያገኙት? (ከአንድበላይመልስመምረጥይቻላል)	1. ከመመሪያ 2. ከስልጠና 3. ከጓደኛ 4. ሌላ (ይጠቀስ) _____
1.7	ከጤናተቋምየሚወጣቆሻሻአወጋገድንበተመለከተወይምበተመሳሳይጉዳይላይከዚህበፊትስልጠናወስደዋል?	1. አልወሰድኩም 2. አዎ
1.8	የሄፓታየተስ B ቫይረስመከላከያክትባትወስደዋል?	1. አልወሰድኩም 2. አዎ
1.9	የጤናተቋምቆሻሻአወጋገድንበተመለከተበክፍሉውስጥመመሪያ/ ለአገልግሎትየተዘጋጀሰነድአለ?	1. የለም 2. እርግጠኛአይደለሁም 3. አዎ

ክፍል2: ከዘውዲቱሆስፒታል/ ከኮሪያዎችሆስፒታልየሚወጣቆሻሻአወጋገድንበተመለከተየጤናባለሙያዎችንእውቀትለመለካትየተዘጋጀመጠይቅ

እባክዎትንለእንዳንዱጥያቄከቀረቡለትየመልስአማራጮችመካከልለእርስዎየሚሰማማውንየመልስአማራጭላይምልክትያድርጉ፡፡

ተ.ቁ	የጤናባለሙያዎችንእውቀትለመለካትየተዘጋጁጥያቄዎች	አማራጭመልሶች	
		አይደለም	አዎ
2.1	ከጤናተቋምስለሚመነጭቆሻሻአዎጋገድያውቃሉ?		
2.2	ከጤናተቋምየሚመነጭቆሻሻለጤናአደገኛነውን?		
2.3	ለህክምናአገልግሎትየዋለስለታማ/ሹልነግርቢዎጋንአሳሳቢሊሆንይችላል?		

2.4	የግልንፅህናንለመጠበቅየምንጠቀምባቸውቁሳቁሶችንበመጠቀምበበሽታየመያዝዕድልንመቀነስይቻላል?		
2.5	ከጤናተቋምየሚወጡቆሻሻዎችንየተለያየየቀለምምልክትባላቸውማስቀመጫዎችለያይቶስለማስቀመጥያውቃሉ?		
2.6	በሽታአምጭረቂቅተዋስያንሊይዝየሚችልየቆሻሻማስቀመጫእቃየባዮሃዛርድምልክትሊኖረውይገባልን?		
2.7	ከጤናተቋምየሚወጣቆሻሻከምንጩተለይቶመቀመጥይኖርበታል?		

2.8. ከሚከተሉትውስጥበዓለምአቀፍደረጃለአደገኛበሽታአምጭረቂቅተዋስያንምልክትየሆነውየቱነው?

1. 
3. 
2. 
4. 

2.9. ከሚከተሉትውስጥየትኛውአይነትየጤናተቋምቆሻሻከቢጫየቆሻሻማጠራቀሚያላይመቀመጥይኖርበታል?

1. ተላላፊበሽታአምጭ
3. ሌላአይነትቆሻሻ
2. ተላላፊበሽታየማያመጣ
4. አላውቅም

2.10. ከሚከተሉትውስጥየትኛውአይነትየጤናተቋምቆሻሻከጥቁርየቆሻሻማጠራቀሚያላይመቀመጥይኖርበታል?

1. ተላላፊበሽታአምጭ
3. ሌላአይነትቆሻሻ
2. ተላላፊበሽታየማያመጣ
4. አላውቅም

2.11. ስለታማናሹልነገሮችከየትኛውየቆሻሻማስቀመጫላይመቀመጥይኖርባቸዋል?

1. ከጥቁርቢን
3. ከሴፍቲቦክስ
2. ከቢጫቢን
4. አላውቅም

2.12. ስለታማናሹልነገሮችየሚቀመጡበትእቃ (ሴፍቲቦክስ) ቢበዛአስከምንድረስመሙላትአለበት?

1. እስከግማሽድረስ
3. ሙሉበሙሉ
2. እሩብእስኪቀረው
4. አላውቅም

2.13. እንደአለምየጤናድርጅትመመሪያመሰረትለኤችአይቪለተጋለጠሰውየሚሰጠውየመከላከየመድሀኒትቢበዛእስከስንትሰዓትዘግይቶሊሰጥይችላል?

1. 24 ሰዓት
3. 72 ሰዓት
2. 48 ሰዓት
4. አላውቅም

ክፍል3: ከዘውዲቱሆስፒታል/ከኮሪያዎችሆስፒታልየሚወጣቆሻሻአወጋገድንበተመለከተየጤናባለሙያዎችንአመለካከትለመለካትየተዘጋጀመጠይቅ

በሚከተለውየመለኪያደረጃመሰረት1-5 ((1=በጣምአልስማማም(በአ); 2= አልስማማም(አ); 3= ገለልተኛነኝ (ገ); 4= እስማማለሁ (እ) እና5=በጣምእስማማለሁ(በእ)) በማለትከታችከሰንጠረዡውስጥላሉትጥያቄዎችለእርስዎየሚስማማውየመልስአማራጭላይምልክትያድርጉ፡፡

ተ.ቁ	በሚከተሉትነጥቦችላይየእርስዎእምንትወይምአመለካከትምንድንነው?	በአ	አ	ገ	እ	በእ
3.1	ከጤናተቋምየሚወጣቆሻሻንትክክለኛባልሆነመንገድማስወገድለተላላፊበሽታሊያጋልጥይችላል :					
3.2	ኤችአይቪከጤናተቋምበሚወጣቆሻሻአማካኝነትሊተላለፍይችላል::					
3.3	የኤችአይቪፖስትኤክፖዠርፕሮፍላክሲስኤችአይቪንለመከላከልይረዳል::					
3.4	ሄፓታይተስ B ቫይረስከጤናተቋምበሚወጣቆሻሻአማካኝነትሊተላለፍይችላል::					
3.5	ሄፓታይተስ C ቫይረስከጤናተቋምበሚወጣቆሻሻአማካኝነትሊተላለፍይችላል::					
3.6	ከጤናተቋምየሚወጣቆሻሻምንምአይነትተላላፊበሽታሊያስተላልፍአይችልም::					
3.7	ከጤናተቋምየሚወጡቆሻሻዎችንገናከመፍለቂያቸውባይነትባይነታቸውለያይቶማስቀመጥቆሻሻውንለመያዝእምነትእንዲኖረንያደርጋል፡፡					
3.8	የቆሻሻማስቀመጫዕቃዎችንመሰየምምንምጠቀሜታየለውም::					
3.9	ከጤናተቋምየሚወጣቆሻሻንበፀረ-ተዋስያንማከምበበሽታየመያዝእድልንመቀነስይቻላል::					
3.10	የግልንፅህናመጠበቂያመሳሪያዎችንበመጠቀምለበሽታአምጭረቂቅተዋስያንየመጋለጥእድልን መቀነስይችላል::					

ክፍል4.ከዘውዲቱሆስፒታል/

ከኮሪያዎችሆስፒታልየሚወጣቆሻሻአወጋገድንበተመለከተየጤናባለሙያዎችንተግባርለመለካትየተዘጋጀመጠይቅ በጥያቄቁጥር 4.3 በበቂሁኔታማለትለአንድቀንአገልግሎትየሚሆንዓንትበክፍሉዉስጥመኖሩንለመግለፅነው፡፡እንዲሁምበጥያቄ 4.8 እና 4.9 ሁልጊዜ፡ማለትየተጠቀሰውንየግልንጽህናመጠበቂያመሳሪያምንግዜምመጠቀምዎንለመግለጽነው፡፡አንዳንዴ፡የተጠቀሰውንየ ግልንጽህናመጠበቂያመሳሪያአልፎአልፎመጠቀምዎንለመግለጽነው፡፡

አልጠቀምም፡ማለትበሚሰሩበትወቅትከቆሻሻጋርግነኙነትሲኖርዎየተጠቀሰውንየግልንጽህናመጠበቂያመሳሪያያፈጽሞአለመ ጠቀምንለመግለጽነው፡፡እባክዎትንቀጥሎለቀረቡትጥያቄዎችለእርስዎየሚስማማውንመልስይምረጡ፡፡

ተ.ቁ	ጥያቄዎች	የመልስአማራጭ		አስተያየት
4.1	ባለፉት 12 ወራትውስጥከጤናተቋምቆሻሻውስጥከስለታማነገሮችጋርግንኙነትያለውጉዳትደርሶብ ዎትያውቃል?	የለም	አዎ	
4.2	ከቆሻሻማስቀመጫዎችአጠገብቆሻሻዎችንእንዴትለያይተንማስቀመጥእንዳለብንየሚገ ልጽየተለጠፈስዕልዎይምተዕዛዝአለ?	የለም	አዎ	

4.3	በጤናተቋሙውስጥጓንትበበቂሁኔታአለ?	የለም	አዎ	
4.4	እርስዎየቆሻሻማጠራቀሚያእቃዎችንይሰይሚቸዋል?	የለም	አዎ	
4.5	ሶስቱምአይነትየቆሻሻማስቀመጫእቃዎች/ቢኖች (ጥቁር፡ቢጫናሴፍቲቦክስ) በክፍልዎውስጥአሉ?	የለም	አዎ	
4.6	የጤናአገልግሎትበሚሰጡበትወቅትየሚፈጠሩቆሻሻወችንባይነትባይነታቸውለያይተ ውያስቀምጧቸዋል?	የለም	አዎ	
4.7	በጥያቄ 4.6 መልስዎአዎከሆነየተለያየየቀለምምልክትባላቸውማስቀመጫዎችበመጠቀምለያይተው ያስቀምጧቸዋል?	የለም	አዎ	አይደለምከሆ ነያቁሙ
4.8	የጤናተቋምቆሻሻበሚይዙበትግዜምንያህልየእጅጓንትይጠቀማሉ?	1. አልጠቀምም 2. አንዳንዴ 3. ሁልጊዜ		
4.9	በጤናተቋምበሚሰሩበትግዜወይምቆሻሻበሚይዙበትግዜምንያህልጋወንይጠቀማሉ?	1. አልጠቀምም 2. አንዳንዴ 3. ሁልጊዜ		

4.10.

ከሰውነትበሚወጡፈሳሾችያልተበከሉናበሽታአምጭረቂቅተዋስያንንሊይዙየማይችሉየጤናተቋምቆሻሻወችንእንደወረቀት፡ ፕላስቲክናመሰልነገሮችንከምንላይያስቀምጣሉ?

1.ከጥቁርየፕላስቲክእቃ 3.ከሌላየቆሻሻማስቀመጫ----------

2. ከቢጫየፕላስቲክእቃ -

4.11. በሽታአምጭረቂቅተዋስያንንሊይዙበሚችሉበደምወይምከሰውነትበሚወጡፈሳሾችየተበከሉእንደጥጥ፡ፋሻእናመ ሰልየጤናተቋምቆሻሻዎችንከምንላይያስቀምጣሉ?

1.ከጥቁሩየፕላስቲክእቃ 3.ከሌላየቆሻሻማስቀመጫ----------

2.ከቢጫየፕላስቲክእቃ --

4.12. ለህክምናአገልግሎትየዋሉስለታማነገሮችንከምንላይያስቀምጣሉ?

1.ከሴፍቲቦክሰስ 3.ከቢጫየፕላስቲክእቃ

2.ከጥቁርየፕላስቲክእቃ 4.ከሌላየቆሻሻማስቀመጫ----------

ውድየጥናቱተሳታፊስለትብብርዎበጣምእናመሰግናለን፡፡

ቀን----------

የጤናተቋሙመለያቁጥር _____

የተሳታፊዉመለያቁጥር _____

ክፍል 5: የጤናባለሙያው/ዋሲያገለግል/ ስታገለግልታይቶየሚሞላቅፅ

ተ.ቁ	የሚታዩተግባራት	የመልስአማራጭ		አስተያየት
		የለም	አዎ	
5.1	ከጤናተቋምየሚወጣቆሻሻንእንዴትለያይተንማስቀመጥእንዳለብንየሚያሳይየተለጠፈስዕልወይምመመሪያከቆሻሻማስቀመጫዎችአጠገብአለ?			
5.2	በጤናተቋሙውስጥጓንትበበቂሁኔታአለ?			
5.3	በስራላይጓንትተጠቅሟል/ለች?			
5.4	በስራላይጋውንተጠቅሟል/ለች?			
5.5	በክፍሉውስጥቢጫየቆሻሻማስቀመጫእቃአለ?			የለምከሆነወደ 5.7 ይለፉ
5.6	አዎከሆነተላላፊበሽታአምጭተዋስያንሊይዝየሚችልቆሻሻብቻይዟል?			
5.7	በክፍሉውስጥጥቁርየቆሻሻማስቀመጫእቃአለ?			የለምከሆነወደ 5.9 ይለፉ
5.8	አዎከሆነተላላፊበሽታሊያመጣየማይችልቆሻሻብቻይዟል?			
5.9	በክፍሉውስጥየአደገኛተዋስያንምልክትያለውሴፍቲቦክስአለ?			
5.10	ቆሻሻዎችንባይነትባይነታቸውለይቶ/ታአስቀምጧል/ለች?			
5.11	በክፍሉውስጥያሉትሁሉምየቆሻሻማስቀመጫቢኖችተሰይመዋል?			
5.12	በክፍሉውስጥከ¾ኛበላይየሞላተላላፊበሽታአምጭረቂቅተዋስያንሊይዝየሚችል የቆሻሻማስቀመጫእቃ /ሴፍቲቦክስአለ?			

ቀን----------

የጤናተቋሙመለያቁጥር _____

የተሳታፊውመለያቁጥር----------

ክፍል 6: የፅዳትሰራተገኛው/ዋሲያገለግል/ ስታገለግልታይቶየሚሞላቅፅ

ተ.ቁ	ጥያቄዎች	መልስ
6.1	የትኛውየግልጤናመጠበቂያዕቃበጤናተቋሙይገኛል? (ከአንድበላይመልስመስጠትይቻላል)	1. የከባድስራዓንት 2. ረጅምጫማ 3. ሽርጥ 4. ምንምየለም
6.2	ሲያፀዱ/ ቆሻሻሲያስዎግዱየከባድስራዓንትተጠቅመዋል?	1. አይደለም 2. አዎ
6.3	ሲያፀዱ/ ቆሻሻሲያስወግዱረጅምጫማተጠቅመዋል?	1. አይደለም 2. አዎ
6.4	ሲያፀዱ/ ቆሻሻሲያስዎግዱሽርጥተጠቅመዋል?	1. አይደለም 2. አዎ
6.5	ሲያፀዱ/ ቆሻሻሲያስወግዱበድጋሚአገልግሎትላይየሚውሉዕቃዎችንበፀረ-ተዋህሲያን (በክሎሪን) ታፀዳቸዋለች/ያፀዳዋል?	1. አይደለም 2. አዎ
6.6	ተጠያቂውየህክምናአገልግሎትመስጫክፍሎፍሎችውስጥያሉትንቆሻሻዎችበ 24 ሰዓትውስጥአውጥተዋቸዋል?	1. አይደለም 2. አዎ
6.7	ቆሻሻዎችንባይነትባይነታቸውእንደተለዩለየብቻቸውአጓጉዘዋል?	1. አይደለም 2. አዎ
6.8	ለማጓጓዣምንአይነትእቃተጠቀሙ? (ከአንድበላይመልስመምረጥይቻላል)	1. የሚገፋተሽከርካሪ/ ጋሪ 2. ክዳንያለውባልዲ 3. ክዳንየሌለውባልዲ 4. ሌላ(ይጠቀስ)_____
6.9	በሚየጓጉዙበትወቅትየቆሻሻመያዣእቃውሙሉለሙሉተከድኗል?	1. አይደለም 2. አዎ

ቀን----------

የጤናተቋሙመለያቁጥር _____

ክፍል 7፡የጤናተቋሙንየቆሻሻአወጋገድሁኔታበመንብኘትተመልከቶየሚሞላመጠይቅ

7.1.ተቋሙምንዓይነትከጤናተቋምለሚወጣቆሻሻጊዜያዊማቆያይጠቀማል?

1. ለቆሻሻማቆያተብሎየተዘጋጀክፍል
2. ስለታማወይምሹልሊበሳውየማይችልእቃ
3. ሌላካለይገለፅ_____

7.2.ከሁለትቀንበላይተጠራቅሞየቆየተላላፊበሽታአምጭረቂቅተዋስያንሊያመጣየሚችልቆሻሻአለ?

1.አዎ

1. 2. የለም

7.3.ጤናተቋሙበግቢውውስጥተላላፊበሽታሊያመጡየሚችሉቆሻሻዎችንያከማል? (የለምከሆነያቁሙ)

1.አዎ 1. 2. የለም

7.4.በጥያቄቁጥር 7.3 መልሱአዎከሆነምንዓይነትየማከሚያዘዴይጠቀማል? (ከአንድበላይመልስመምረጥይቻላል)

1. የተጠበቀማቀጣጠያ 1. 4. ያልተጠበቀማቀጣጠያ
2. ማምከን 2. 5. ሌላካለ (ይጠቀስ)____
3. ኬሚካል

Annex 3: Supporting Documents

ቅድስት ማርያም ዩኒቨርስቲ
ድኅረ-ምረቃ ት/ቤት

St. Mary's University
School of Graduate Studies

☎+251-11-552-45 37/66 ✉1211, 18490 Fax 552 83 49 e-mails: sgs@smuc.edu.et, Addis Ababa, Ethiopia

Ref.No. smussso/RP 0154/19
Date: - May 14, 2019

Request for Cooperation

TO: Zewditu Memorial Hospital

Ms. **Seble Lemma,** ID No. **SGS/0057/2010B** is a graduate student in the department of **General Management.** She is working on her thesis entitled "**Knowledge Attitude and Practice of Health Care Staffs in Waste Management : A Comparative Study of Public and Private Hospitals in Addis Ababa. e.**" and would like to collect data from your Organization.

Therefore, I kindly request your good office to allow her to access the data she needs for her research.

Any assistance rendered to her is highly appreciated.

Sincerely

Hamere Yimer
Guidance Counselor & Thesis Coordinator

ቅድስት ማርያም ዩኒቨርስቲ
ድኅረ-ምረቃ ት/ቤት

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አዲስ አበባ ከተማ አስተዳደር ጤና ቢሮ
City Government of Addis Ababa Health Bureau

Ref.No. ጤአመ/2982/227
Date 6/8/12

TO:

Zewiditu memorial hospital
- **MCM General Hospital**

Addis Ababa

Subject: Request to access Facilities to conduct approved research

The letter is to support **Seble Lemma** of "**ANALYSIS OF KNOWLEDGE, ATTITUDE AND PRACTICES AMONG HEALTHCARE STAFFS TOWARDS HOSPITAL WASTE MANAGEMENT: A COMPARATIVE STUDY OF ZEWDITU MEMORIAL HOSPITAL (PUBLIC) AND MCM GENERAL HOSPITAL (PRIVATE), Addis Ababa, Ethiopia .**' The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required. Therefore we request the facility and staffs to provide support to the principal investigator.

With Regards

Ethical Clearance Committee

ዶ/ር ዮሐንስ ወ/ሺዳን
የአ/ረተሰብ ጤና ምርምር
ቡድን መሪ

Cc

- **Seble Lemma**
- **To Ethical Clearance Committee**

አዲስ አበባ ከተማ አስተዳደር ጤና ቢሮ
City Government of Addis Ababa Health Bureau

Ref.No 7/7/ም 2937/227

Date 6/8/12

TO:

- **Zewiditu memorial hospital**
- **MCM General Hospital**

Addis Ababa

Subject: Request to access Facilities to conduct approved research

The letter is to support **Seble Lemma** of "**ANALYSIS OF KNOWLEDGE, ATTITUDE AND PRACTICES AMONG HEALTHCARE STAFFS TOWARDS HOSPITAL WASTE MANAGEMENT: A COMPARATIVE STUDY OF ZEWDITU MEMORIAL HOSPITAL (PUBLIC) AND MCM GENERAL HOSPITAL (PRIVATE), Addis Ababa, Ethiopia .**' The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required. Therefore we request the facility and staffs to provide support to the principal investigator.

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Ethical Clearance Committee

Cc

- **Seble Lemma**
- **To Ethical Clearance Committee**

The Addis Ababa City Administration Health Bureau

ዶ/ር ዮሐንስ ወ/ሚዳን
የህብረተሰብ ጤና ምርምር
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Annex 4: Pictures from the Study