

UNIVERSITY OF EDUCATION, WINNEBA



**MANAGEMENT PRACTICES OF MEDICAL WASTE
AMONG HEALTHCARE FACILITIES: THE CASE OF THE
SEKYERE ENCLAVE OF ASHANTI REGION OF GHANA**

**ADAMS YAW IBRAHIM
(MASTER OF PHILOSOPHY)**

2021

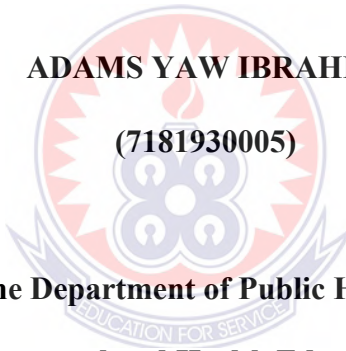


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FACILITIES: THE CASE OF THE SEKYERE ENCLAVE OF ASHANTI REGION
OF GHANA**

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**A thesis in the Department of Public Health Education,
Faculty of Environmental and Health Education, submitted to the
School of Graduate Studies in partial fulfillment
of the requirements for the award of the degree of
Master of Philosophy
(Environmental and Occupational Health Education)
in the University of Education, Winneba**

OCTOBER, 2021

DECLARATION

STUDENT'S DECLARATION

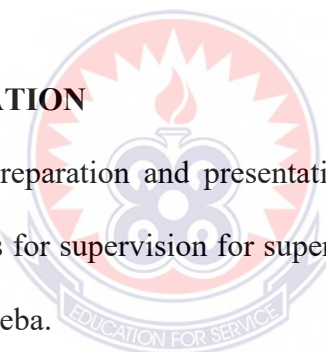
I, ADAMS YAW IBRAHIM, declare that this thesis is my own research work and it contains no information that has previously been published except for references to other authors' works which were duly acknowledged, and that it has neither in whole nor partially been presented for another degree in this university or elsewhere.

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SUPERVISORS' DECLARATION

We hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision for supervision of thesis as laid down by the University of Education, Winneba.



Dr Richard Amankwahs Kuffour (Principal Supervisor)

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DATE:.....

DEDICATION

I dedicate this work to the Creator and sustainer of the universe who made this possible



ACKNOWLEDGEMENT

My profound gratitude goes to Jehovah God for the guidance and protection throughout my work. I owe great debt to my supervisors Dr. Richard Amankwah Kuffour and Dr. Denis Dekugmen Yar of the Department of Public Health Education, and Faculty of Environment and science Education, University of Education, Winneba, (UEW) respectively for their encouragement, guidance and constructive criticism throughout this survey work.

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ABSTRACT

Management of medical waste (MW) is an important subject bedeviling many developing countries like Ghana. Countries across the globe are struggling to develop methods and infrastructure for appropriate disposal of the increasing medical waste generated. This study assessed the management practices of medical waste in healthcare facilities in the Sekyere enclave of the Ashanti Region of Ghana. Questionnaires, personal observation and an in-depth interview were employed to obtain data for the work. Data for the study were analysed using descriptive statistics and the results presented in tables and graphs. Medical waste generated were mostly not sorted at the health facilities. All the health facilities had dump sites. Eight (8) out of the Nine (9) health facilities visited had incinerators. Many janitors lacked knowledge on medical waste management. Some janitors indicated there were risk associated with medical waste handling. About half 47% said diseases were the major risks while about one-third 34% said needle pricking. The study revealed that mortuaries engaged in open burning of waste. Liquid waste from mortuaries were discharged into general sewage systems. Most facilities 39% burnt their waste in the open. Landfill recorded, 33% and burning and landfill 28%. All medical storage areas must be large enough so they do not overflow and separate spaces must be provided for different types of waste. All the health facilities engaged in segregation of waste at the point of generation but the segregated waste ended up being mixed with the municipal solid waste. It is recommended that the assemblies ensure that methods used to transport medical waste should be appropriate to the individual circumstances of health facilities and compliant with national transport regulations that is stipulated in the ministry health medical waste policy regulation.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Medical waste is any untreated solid or liquid material generated as a result of the diagnosis and treatment of humans or animals during the performance of medical research and laboratory processes (MOH, 2020). Medical waste management means the management of waste produced using techniques that will check the spread of diseases (Junaid *et al.*, 2017). Medical waste covers diverse range of materials that include infectious waste, pathological waste, sharps, chemicals, pharmaceuticals, genotoxic waste, radioactive waste and heavy metals waste (WHO, 2018; Letho *et al.*, 2021).


Generally, waste can be classified as non-hazardous waste and hazardous waste based on their level of health risk. An estimated 80% of waste generated by health institutions are considered non-hazardous and does not post any health risk to persons who handle it (WHO, 2018; Alwa *et al.*, 2017). Examples of non-hazardous waste include paper, trash, boxes, bottles, plastic containers and food. They can be discarded by burning or sent to the local landfill or dumpsite. The remaining 20% of waste generated by health facilities are classified as hazardous (WHO, 2020). Waste considered hazardous include tissue and body parts, expired drugs, disinfectants, sharps, blades and used nose mask (Shinde *et al.*, 2020).

The source of contaminated medical waste is not only produced from the health facilities including hospitals and temporal medical facilities but also generated by household and quarantine center facilities. (Badeenezdad *et al.*, 2021), that post great adverse effects on

both human and the environment due to their carcinogenicity, toxicity, corrosiveness and infectiousness etc. The hazardous medical waste can further be classified as biological, chemical and radioactive (Liu & Mishra *et al.*, 2021). According to WHO, out of 365 tons of medical waste generated annually, only 20% were hazardous while 80% were non-hazardous (WHO, 2020). Even though hospital wastes are only 10%-25% infectious and 75%-90% non-infectious and non-hazardous; their non-segregation makes the whole waste (100%) infectious, (Khalid *et al.*, 2021). World Health Organization (WHO) suggested that disposal of healthcare waste and treatment should consider the controlled operating conditions of thermal treatment or use biocidal agents to destroy any pathogens (Das *et al.*, 2020).

Studies have showed that medical waste management has not received the needed attention and priority in developing countries (Bakeri *et al.*, 2018, Letho *et al.*, 2021). If hospital waste is not properly managed and disposed of, injuries can arise from contaminated sharps leading to infections (Tirkolaei *et al.*, 2021; Aleanizy *et al.*, 2021). In recent times in Ghana, majority of healthcare facilities are all subscribed to the communal collection system which is spearheaded by Zoomlion Ghana Company Limited. This is due to the lack of available structures for medical waste management. The companies handling of medical waste have been below standard practice where medical waste is being added to general municipal solid waste which defies the Ministry of Health policy regulation on medical waste management. Though the company's main aim is to employ modern technologies in the effective management of waste in the country. However, the inadequate training of waste disposal staff to appropriately handle waste impedes all the waste management processes. It is

generally recommended that hospital waste should be segregated at point of generation, stored in appropriate colour coded containers, treated, transported and disposed of in a proper and safe manner (Zamparas *et al.*, 2019). However, (Imani Africa, 2016; Adu *et al.*, 2020; Odonkor *et al.*, 2020) on medical waste management do not lay emphasis on the available structures and its operational practices creates a major problem in the overall medical waste management architecture. The current study places importance on the available structures and systems for the management of medical waste. The options available for the treatment of hospital waste before final disposal may include incineration, mechanical/chemical disinfections, microwave disinfections and autoclaving, taking into account the composition of the waste and environmental conditions (Wang *et al.*, 2020; Tabrizi *et al.*, 2019).

The logo of the University of Education, Winneba, is a circular emblem. It features a central figure of a person with arms raised, set against a background of a sunburst. Below the figure is a banner with the motto 'EDUCATION FOR SERVICE'. The entire emblem is surrounded by a decorative border.

The proper management of hospital waste mainly depends on the commitment of institutional administration, proper legislations, involvement of all stakeholders in the waste management process and a dedicated budget allocated for waste in each health institution (WHO, 2018; MOH, 2020; Mogabi, 2018; Akum, 2014). However, medical waste disposal in most health facilities are left in the hands of private waste management companies without instituting an integrated approach which will bring all stakeholders together to ensure strict compliance of policy regulations (Imani, 2016). Ghana, with a population of about 31 million people has weak medical waste standard system coupled with weak enforcement of legislations (Adu *et al.*, 2020). Furthermore, lack of treatment plants, incinerators, etc. can results in improper disposal of waste which has environmental consequences (Akum, 2014; Asante *et al.*, 2014). According to the World Health

Organization (WHO), national legislation is the basis for improving medical waste management practices in any country. It establishes the legal controls and permits the national agency responsible for the disposal of medical waste, usually the Ministry of Health, to apply pressure for their implementation. The law should be complemented by a policy document, and by technical guidelines developed for implementation of the policy. National combined with rigorous enforcement, is thus one of the major prerequisites for effective management of Healthcare waste in Ghana (MOH, 2020). Since a comprehensive and a detailed Ministry of Health Policy guideline on healthcare waste management was published in March 2006 and subsequently reviewed in January 2020 in Ghana, there is still much to be done to effectively ensure the strict compliance of the policy. National legislation on handling healthcare waste is not properly given the needed attention and this has led to the inappropriateness of generally handling medical waste in the health facilities in Ghana (MOH, 2020). Medical waste management policy adherence will help to strictly observe all medical waste management practices and failure to effectively enforce policy guidelines will impede the overall medical waste management processes.

1.2 Problem Statement

The Sekyere enclave comprises (7) districts and Municipals in the Ashanti Region of Ghana. These districts and municipals have health facilities that are used to provide the health needs of the people in providing healthcare to the people. These health facilities contribute to medical waste generation which needs much attention. Many studies have shown that, standard practices of managing medical waste are not being attended to appropriately. This points out that, the management of medical waste expose waste handlers, healthcare staff,

patients, surrounding neighborhood and largely the environment to serious hazards and threat. Sadly, there has not been proper structures and adequate knowledge on handling medical waste especially with waste handlers in the Sekyere enclave. Health workers are often exposed to some infectious diseases due to exposure to medical waste that can lead to infections such as viral hepatitis A, B C, respiratory infections septicemia, HIV infections, cuts and abrasions etc. (Chowdhary, 2018; Mohammed *et al.*, 2017).

In the Sekyere enclave, healthcare facilities resort to open burning of solid medical waste while liquid waste is discharged through drainage systems. Medical waste collected end up being disposed together with the Municipal waste in the Sekyere enclave. The unfenced nature of the dump sites of health facilities has paved way for children to play around and sometimes pick hazardous items such as surgical blades, used hand gloves, blood infusion bags, needles and syringes etc. This becomes dangerous to the lives of these children. This was observed based on the recognizance survey carried out at the study area by the researcher. Although some studies have been done in Ghana, these are limited to the regional capitals, however in the Sekyere enclave there is not positive empirical data on medical waste management (Adu *et al.*, 2020). This has become crucial as the study areas associated are known for receiving and treating patients on daily bases and the subsequent generation of medical waste could have consequence on waste handlers and staff working in the health facilities. It is against this background that; the study seeks to examine the management practices of medical waste in the Sekyere enclave.

1.3 Justification

Putting into perspective the risk, both on human health (patients, hospital staff and nearby communities) and the environment, the rapid increase in the generation of medical waste has become alarming and needs urgent attention. (Mohammed *et al.*, 2017). In Ghana, the Environmental Protection Agency (EPA), Ministry of Local Government and Rural Development (MLGRD) and the Ministry of Health acknowledge the demand for proper and adequate medical waste management practices since this will provide a positive influence on the environment (MOH, 2020). Moreover, according to some studies, there is enormous risk involved in the handling of medical waste in the health facilities in Ghana (Odonko *et al.*, 2020). These have led to serious injury to health workers such as cut and abrasions and other infectious diseases such as respiratory tract infections, corona virus infection, hepatitis A, B, C, HIV/AIDS, Cholera, Skin infection, etc. These are due to the poor operational and management practices in handling medical waste (Chowdhary *et al.*, 2018). Although, some studies have been conducted in developed countries and in some developing countries on medical waste generation and management such cannot be said about the situation in Sekyere Enclave. (Odonko *et al.*, 2020. Mohammed *et al.*, 2017). This study therefore seeks to assess the management practices of medical waste in the Sekyere Enclave in Ashanti Region.

1.4 Objectives of the Study

The main aim of this study was to assess the management practices of medical waste in health facilities and among healthcare care workers in the Sekyere enclave of the Ashanti Region.

1.4.1 Specific Research Objectives

The specific objectives are;

- i. To evaluate the existing structures and operational practices for medical waste management in health facilities and among healthcare workers in the Sekyere enclave.
- ii. To determine the challenges and opportunities that exist in the management of medical waste in the Sekyere enclave.
- iii. Assess the knowledge, attitudes, risk and perceptions among healthcare workers on medical waste management in the Sekyere enclave.
- iv. Assess management practices of mortuary waste generated in the Sekyere enclave.

1.5 Research Questions

The research questions that were addressed included:

- I. What are the existing structures and practices for the management of medical waste?
 - ii. What opportunities and challenges are inherent with management of medical waste?
 - iii. How often do waste management staff undergo training?
- v. How are mortuary and liquid waste managed at health facilities in the Sekyere enclave?

1.6 Significance of the Study

Healthcare facilities in the Sekyere enclave of Ashanti Region of Ghana serve many people. These facilities have the potential of generating huge amount of hospital-based waste due to the large number of people the health facilities receive on daily basis. Enhanced strategies on medical waste generated at these facilities and how the waste is managed are urgently needed for planning and policy formulation. Data from this study will provide up to date

data and on management of hospital waste in the Sekyere enclave. The results of this study will provide hospital management with empirical data for the formulation of policies and programs that could improve source separation, collection, treatment and disposal. Again, this study will provide useful and functional information for persons who handle hospital waste, the health workers and the general public at large on the potential dangers that can arise as a result of improper management of medical waste in the Sekyere enclave. This study would further stimulate future research and also contribute to literature in medical waste management.

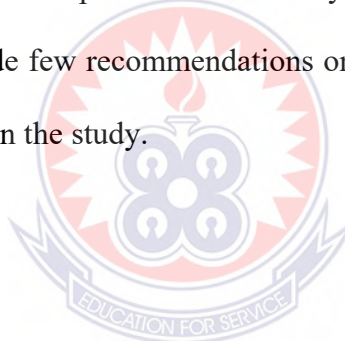
1.7 Delimitation of the Study

The study was limited to the Sekyere enclave in the Ashanti region of Ghana. The study focused on assessing the management practices of medical waste among healthcare facilities and workers in the Sekyere enclave of Ashanti region. Reviewing of literature was based on healthcare waste management, such as waste generation, collection, storage, treatment, disposal and usage of safety materials for waste collection etc. It also includes public and private mortuary facilities and how they manage their waste was reviewed.

1.8 Organization of the Study

Chapter one introduces the study and provides the outline of the study. It captures the background information, problem statement and objective of the study, research questions, and significance of the study, and scope of the research, limitations and delimitations of the study. Chapter two deals with the review of literature related to the subject of study. The review involves in-depth studies related to the problem under study. The third chapter

describes the methodology used in the study. Specifically, the research design, the research instrument and tools, sample and sampling technique, the procedures for data collection and the data analysis are discussed. The analysis, results and discussion are presented in chapter four. This chapter captures the interpretation of all the interview responses and content analysis of the data collected on the field of study. The chapter deals with issues such as the responses of the role of the hospital workers at the hospital's facilities. The interpretations were presented in the form of graphs and pie charts. Explanations to the data analysis was done using some of the responses collected during the field study and the available secondary data. In chapter five, the main focus was the summary, conclusions and recommendations. The Chapter six provides a summary of all the chapters in the study. In addition, the chapter also made few recommendations on alternative development approach before drawing a conclusion on the study.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Medical care facilities diagnose and treat people by way of healing them to save lives but their activities also generate waste in the course of providing health care (Alwa *et al.*, 2020; WHO, 2020). The management and treatment of medical waste (WM) are of enormous concern owing to its immense potential hazard to the health of humans and the environment, specifically in developing countries like Ghana (Litho *et al.*, 2021; Ikeda, 2019; Dailystar, 2020). Although guidelines exist on the prevention and management of waste across the globe, its implementation is still stamped by technological, economic, social difficulties and inadequate training of staff responsible for handling these waste (Kenny *et al.*, 2021).

2.2 Meaning of Medical Waste (MW)

Medical waste refers to all categories of waste generated from health facilities, clinics, animal husbandries, veterinary hospitals and other clinical laboratories, and home based treatment of patients. (Letho *et al.*, 2021). Medical waste (MW) includes all solid and liquid waste (both hazardous and non-hazardous) generated while performing medical procedures, or during the performance of medical research involving humans and animals (Ikeda, 2019). Whatever the terminology used, the most important thing is that, it should be waste arising or generated from a health establishment. Hospital waste is also defined as any waste produced by health institutions which may include needles, syringes, blood samples, body tissues, chemicals, medical devices, soiled dressings, pharmaceuticals and radioactive materials (WHO, 2020). Healthcare waste includes waste generated within health-care

institutions, research centers and laboratories. It also includes waste originating from minor and scattered sources, including waste produced in the course of healthcare undertaken in the home (e.g. home dialysis, self-administration of insulin, recuperative care. (Okechukwu *et al.*, 2017). Medical waste materials are generated in hospitals, nursing homes, veterinary hospitals, clinics, dispensaries, blood banks, animal houses and research institutions. Medical waste can also be generated in households (Ukechukwu *et al.*, 2017). According to the Ghana Health Service (2020), healthcare waste includes all untreated waste which could be liquid or solid produced during the treatment process of human beings and animals or medical research. Studies have reported that before the COVID- 19 pandemic, over half of the world population was already at risk of threats from environmental pollution and public health due to unsafe disposal of healthcare waste (Pachauri *et al.*, 2019, Gunawardana *et al.*, 2018). They however viewed medical waste as a small component of hospital waste generated in the treatment process of human beings and animals. They concluded that medical waste which has the ability of transmitting disease pathogens is a sub set of hospital waste which must first be addressed by any medical waste management system in any health facility. From the various definitions, it is clear that, health facilities are institutions for the delivery of healthcare services thereby generating waste which have public health implications and must therefore be managed carefully to avoid the potential exposure of health staff, patients and the general public visiting the hospital to diseases.

2.3 Categories of Medical Waste

The waste generated from healthcare settings or contaminated by secretions of medical patients through blood fluids, or other media, is considered medical waste. It is mostly

regulated by national environmental and health departments (EPA, 2020). Most of the medical waste generated from healthcare setting is hazardous and non-hazardous. The generated waste is not always hazardous or more dangerous than general household waste. However, it depends on the type of medical waste that represents different health risk levels. For example, infectious waste, which accounts for 15%-25% of total medical waste include sharp objects, body parts, chemicals or expired medicines, and radioactive and cytotoxic waste (WHO, 2020). It is thus crucial for the proper management of hospital waste by all health institutions (WHO, 2020; UNEF, 2020; ADB, 2020). Literature shows that only small proportion of overall medical waste are considered hazardous waste and mainly originating from clinics and hospitals, with small amount originating from industrial and domestic sources (Panneerselvam, 2016).

The composition of hazardous and non-hazardous waste varies from country to country and depends on the total or overall quantum of waste produced within a country, which is also dependable on a number of factors (WHO, 2020). For instance, in Pakistan it stands at about 20%, whereas in the United States 15% of hospital waste is considered as infectious waste, and in India the range varies between 15-35% (Maleba, 2016). In Ghana, 75% to 90% of hospital waste is comparable to household waste which do not entail any particular hazard while the remaining 10% to 25% is classified as infectious or special waste (MOH, 2020). Kenny *et al.*, (2021) classified or grouped hospital wastes into seven categories namely, infectious waste and non-clinical waste, pathological waste, chemical waste, sharps, pharmaceutical waste and radioactive waste. These various forms of medical waste classifications are elaborated (**Figure 2.1**).



Figure 2.1: Types of Medical Waste (Source: Christian Kenny, 2021)

2.3.1 Infectious Waste

Infectious wastes are waste suspected to contain pathogens and may include viruses, parasites, fungi and bacteria which in their sufficient quantities could cause diseases in susceptible host (Bloom *et al.*, 2018; Nwankwo, 2018; Halemani *et al.*, 2019). Examples may include cultures and stock from laboratories which might be infectious, infectious waste emanating from surgery and autopsy activities such as blood and secretions or excreta. The proportion of hospital waste usually considered as infectious waste is estimated at 20% which needs special arrangement in order to render such waste safe for disposal (WHO, 2020). The remaining 80% is considered non-hazardous and can be disposed of just like the

ordinary household waste (Akum 2014; WHO, 2018). It must be noted that a mixture of general waste and infectious waste renders the entire waste stream unsafe for handling.

2.3.2 Pathological Waste

Pathological waste is another classification of medical waste which consist of waste from body parts, blood, body fluid and human tissue which is capable of transmitting diseases if not properly handled. This form of classification is usually a subset of infectious waste which must be handled with precaution even if such waste contains healthy body parts (Jaiswal, 2017; Baaki *et al.*, 2017; WHO, 2020).

2.3.3 Chemical Waste

Waste containing chemical substance are classified as chemical waste. This could be in the form of liquid, solid or gas which could be hazardous or non-hazardous. Examples of hazardous and non-hazardous chemical waste include formaldehyde used for disinfecting hospital equipment, photographic chemicals used in the X-ray department for the fixing and developing of solutions, solvents (chloride, chloroform, methanol among others) used by various departments of the hospital, organic chemicals such as phenol-based used in scrubbing, mopping, disinfecting or cleaning of hospital floors and inorganic chemicals such as oxidants and alkalis. These wastes could be highly infectious and must be handled and disposed in a safe and proper manner (WHO, 2018; Algha *et al.*, 2018; Zar *et al.*, 2020). Hazardous chemical waste of different composition should be stored separately to avoid unwanted chemical reactions.

2.3.4 Pharmaceutical Waste

Another important classification of hospital waste or medical waste is pharmaceutical waste which include expired drugs, boxes, bottles, expired vaccines and connecting tubing (WHO, 2020). Such waste could also be hazardous to both human and the environment which needs practical steps in discarding or disposing them (WHO, 2018; Adu *et al.*, 2020).

2.3.5 Radioactive Waste

Waste containing radioactive substances are also known as radioactive waste. This waste is generated as a result of in-vitro, in-vivo and tumor localization diagnosis carried out during therapeutic analysis. Radioactive waste contains radionuclides which maybe short half-lives or longer half-lives. The short half-lives lose their activity relatively faster than the longer half-lives. Radionuclides may be grouped into gases and exhaust from stores and fume cupboards, excreta from patients treated and waste from syringes and needles (WHO, 2019; Adu *et al.*, 2021).

2.3.6 Sharps Waste

Medical waste materials such as broken glasses, needles, knives, infusion sets, blades scalpels and pipette that can cause wounds or cuts are regarded as sharp. Sharps are considered hazardous either it is infected or not and should be handled with much precaution (WHO, 2020; Khan *et al.*, 2019) Sharp waste is one of the most dangerous streams to handle due to the high risk of needle stick injuries (NSIs), which can spread serious diseases (Odonkor *et al.*, 2020). This waste stream requires the use of secure, rigid, and impenetrable storage bins (ideally Colour coded bins) (WHO, 2018).

2.3.7 Non-clinical Waste/General Waste

These kinds of waste include, non-contaminated paper, cardboard, drug boxes, food waste, kitchen waste, empty bottles etc. In many cases, these are collected by a local government authority, or general waste contractor. This waste sometimes may potentially be sold for profit in some areas where there is a market for recyclable materials. This type of waste does not put the public at any threat such as biological, chemical, radioactive, or physical (WHO, 2018).

2.4 Risk Associated with Medical Waste

Medical waste or materials if not properly treated and disposed can be hazardous to the environment and health of the population. Medical care institution with an objective of treating and diagnosing of sick people and reducing health challenges, inescapably create waste that is dangerous to human health and threat to the entire environment (Aradhana *et al.*, 2017; Karki *et al.*, 2020). Over the years, human activities have led to the generation of huge volumes of medical waste, especially in the era of COVID-19 pandemic, which has threatened the very survival of human beings in particular and the environment as a whole (WHO, 2020; UNEF, 2020). Poor management of waste in any health institution or facility in this dispensation has the ability of predisposing all persons who come into contact with such medical waste to hospital related diseases due to its infectious nature, coupled with the hazardous nature to the environment (Ansari *et al.*, 2019; Rahman *et al.*, 2020). Persons at risk of infection from infectious medical waste usually include hospital staff, patients, scavengers, waste collectors and visitors. The health risk associated with infectious hospital waste can be classified into (a) risk of trauma, (b) chemical explosion, (c) radioactivity and

environmental pollution (Williams *et al.*, 2021; Peng *et al.*, 2020). A study in Pakistan, suggested that the adherence of medical waste management practices by medical professionals were often neglected hence leading to injuries to themselves and clients of infectious disease (Ramesh *et al.*, 2010). Disease pathogens associated with improper waste management practices include skin diseases, typhoid, parasitoids and viral hepatitis (WHO, 2020; Kenny *et al.*, 2021). In addition, improper waste management could also have serious health implications to the health worker, general public and the environment by causing pollution to the environment (Pachauri *et al.*, 2019; Golam *et al.*, 2021).

2.5 Medical Waste Management

Medical waste management means, the handling of waste produced by using techniques that will monitor the spread of diseases (Junaid *et al.*, 2017). According to WHO reports, the unsafe disposal and management of medical waste not only causes environmental pollution and public health risks but also have implications on human rights due to the little attention paid by international communities (Kumari *et al.*, 2018). Therefore, the accomplishment of an efficient and orderly manner of any solid hospital waste management involves the identification and understanding of the fundamental aspects and relationships in a waste management system. The safe and smooth implementation of any hospital waste management system therefore, depends on a number of factors including appropriate hospital waste management system, adequate knowledge of health staff on health care waste management issues, presence and usage of waste management plans and policies by health institutions, dedicated budget for healthcare waste, devoted waste management team and good hospital administration (Wang *et al.*, 2020; WHO, 2020; MOH, 2020). Other scholars

also recommended the use of appropriate technology and the training of health staff on the appropriate management of healthcare waste (Mugivhisa *et al.*, 2020; Golam *et al.*, 2021). Knowledge and practices of health staff also plays a vital role in the effective management of health care waste. The ability of health staff to be able to identify hazardous and non-hazardous waste is important since contaminated waste can pose serious health threat to any person who comes into contact with such waste (Mannocci *et al.*, 2020). The improper way of handling medical waste leads to very precarious public health consequences and a substantial impact on the environment (Sahelidengle *et al.*, 2018). It is also expected that health professionals have adequate knowledge in dealing with hospital waste and are also able to report injuries resulting from the handling of hospital waste (Karki *et al.*, 2020; Barik *et al.*, 2019). The presence of medical waste management teams in the health facilities is very important for proper healthcare waste management practices in hospitals.

The team is to supervise, advice and manage health care waste. The activities of the waste management teams are to be guided by underpinning waste management plans and policies developed from national legislations on healthcare waste management. Such laws must be enforced in other to ensure effective waste management in every health establishment (WHO, 2019; MOH, 2020). The escalating problem on solid hospital waste management can be attributed to inefficient and inappropriate waste management system, inadequate financial resources and low priority given to waste management issues by many health institutions. (Sai, *et al.*, 2018). Each health institution or facility is thus responsible for its waste generated. In other to achieve a comprehensive and efficient waste management system, all these challenges must be taken into consideration (WHO, 2018). One major issue related to

current hospital waste management practices in many facilities is the fact that many of these facilities are not able to regulate and enforce hospital waste laws (Abayomi *et al.*, 2017). Existing final disposal sites for municipal solid waste in Ghana are not engineered and may be described as crude dumpsites (MLGRD, 2020). There is no segregation of waste at the sources of generation, therefore hazardous and clinical wastes are often handled together with municipal solid waste (Karki *et al.*, 2020).

2.6 Medical Waste Generation

All countries are facing excess waste generation and should have to evaluate their management systems to incorporate disaster preparedness and resilience. Wuhan, the COVID- 19 epicenter, experienced a massive increase of medical waste from between 40 and 50 tons/ day before the outbreak to about 247 tons (You *et al.*, 2020). Presently, over 1.4 billion tons of solid waste are produced each year globally and this figure has witnessed an astronomical increase from year to year (Kenny *et al.*, 2021). Waste generation embodies routine processes through which material which are no longer of use are discarded (Zamparas *et al.*, 2019). Usually, the quantum or volume of waste generated by a health institution depends on a number of factors ranging from hospital type, capacity, location, national income and instrumentation to status of the health institution (WHO, 2018). The total quantity of health care waste generated across the world varies from hospital to hospital and from country to country all over the world depending on the area of specialty of the hospitals and national income of countries among others (Yu Hao *et al.*, 2019). It is estimated that in developed nations, hospital waste generated is closer to 5.24 kgs 1 bed/ day with countries such as the Netherlands and USA generating 4.2kgs and 4.5kgs per bed per

day respectively (WHO, 2017). In developing countries and Sub-Saharan Africa, data is limited but the quantity of hospital waste generated is estimated at 1.0 to 2.0 kgs per bed per day for general waste and 0.2 to 0.8 kgs per bed per day for hazardous waste (WHO, 2011). Another study in Egypt indicated daily waste generation of 2.07 kg/bed/day (Abd El-Salam, 2010). Developed nations such as the United States generate healthcare waste of between 4.3 to 5.8 kg per bed per day (Hossain *et al.*, 2016). Out of the total amount of waste generated by healthcare activities, about 80 % is general waste comparable to domestic waste. The remaining 20 % is considered hazardous materials that may be infectious, toxic or radioactive and would require appropriate disposal (WHO, 2018; Kenny *et al.*, 2021). Other studies however indicate that estimated municipal waste varies from country to country (Ghanbari *et al.*, 2021).

Other scholars are also of the view that estimated healthcare waste generated in some parts of Eastern Africa specifically Tanzania is 50 % of healthcare waste (Manyela & Lyasenga, 2010). This indeed contributes to both environmental and health repercussions on the immediate hospital and the larger population in the country (Kenny *et al.*, 2021). Generally, waste generated worldwide in advanced countries is greater than those generated in middle income and developing nations with generation rate of about 6 kg to 3 kg per person per year (Ramesh *et al.*, 2010). In 2018, the department of waste of the Metropolitan Assembly of Accra conducted a study in some major hospitals in Accra which estimated that the unit of healthcare waste produced to be 1.2 kg/bed/day. The study also revealed that the waste produced vary in proportion to the level of cases handled, the number of in- and out- patients and the number of auxiliary departments and units within the facility e.g. out-patient

department, laboratory etc. Thus, the quantum of waste produced were found to be at a higher side in the government hospitals most especially the teaching hospital as compared to the private clinics and health posts. It must be noted that due to limited data base in Ghana not much is known in other parts of the country of how medical waste is managed (MOH).

2.7 Identification, Packing, Labeling and Documentation of Healthcare Waste

Every waste management system is depended on the ability of the waste management team to be able to identify the various types of waste at the point of generation and the level of hazards. Therefore, it is very vital for every waste management team to be able to identify and separate waste appropriately since each waste stream has a way of disposing it in order to avert possible harm to persons who come into contact with it (Wiafe *et al.*, 2015). Hospital waste are expected to be packaged in order to protect persons who come into contact with it from possible injuries and harm that might come about as a result of exposure to such waste (WHO, 2020). It is thus the responsibility of hospital management to provide special containers for the containment of both infectious and non-hazardous waste such as safety boxes and plastic bags (Wiafe *et al.*, 2015). Labelling of hospital waste entails putting adequate information in terms of writing or symbols on waste containers to help waste workers and the general public visiting the hospital to enable them identify each type of waste stream and to also help them place waste appropriately (Torkashvand *et al.*, 2020; Khan *et al.*, 2020). Documentation of health care waste which is often neglected by most developing nations is important in every waste management system across the world. Proper documentation gives an inventory of the quantities of waste generated, the type of waste

generated by each health facility, injuries occurring from the management of waste, budget allocation towards waste issues, treatment and disposal options (Wiafe *et al.*, 2015).

2.8 Segregation and Storage of Medical Waste

Waste generated by health facilities should be segregated to clearly identify the various types of waste before final disposal. The first step for proper management system of medical waste is source reduction, and proper segregation source, as recommended by the WHO (2019). If segregation is difficult and cannot be separated from general waste, then it must be treated as medical waste (Singh *et al.*, 2020; WHO 2020). Segregation is done through the use of colour coding storage systems. Universally, black color is used for general waste e.g. kitchen waste, paper, cardboard and sweeping, yellow is used for infectious waste e.g. sharps, patient waste, human/animal tissue and cultures/specimens and brown code is for hazardous waste e.g. vaccines, expired drugs and chemicals (WHO, 2018; MOH, 2020). Figure 2.2 shows the colour coding bins approved by WHO. Colour coding makes it easier for staff who are handling waste to put waste items into the correct container, and to maintain segregation of the wastes during transport, storage, treatment and disposal. (United Nations, UN, 2020). Storage refers to the way in which the waste is kept during the time it is produced and collected until its final point of disposal. This is categorized into internal storage and external storage. It is advised that labels on waste containers should be clear enough for the entire storage period (MOH, 2020; Kanbar *et al.*, 2020). Studies carried out in most countries on hospital wastes management practices indicated that waste segregation and collection using recommended colour coding containers and storage of waste in safe premises have not been satisfactory (Hemalatha *et al.*, 2021; Shinde *et al.*, 2020). A study

conducted in Bawku in the upper east region of Ghana indicated that there is no place for the storage of medical waste. Hospital wastes were however moved from within the various departments to two (2) large storage containers where all waste from various departments are emptied into within the premises of the hospital which was not covered. The study also pointed out the absence of hospital waste burning practices within the domain of the hospital and recommended that it was a positive practice by the hospital (Akum, 2014).

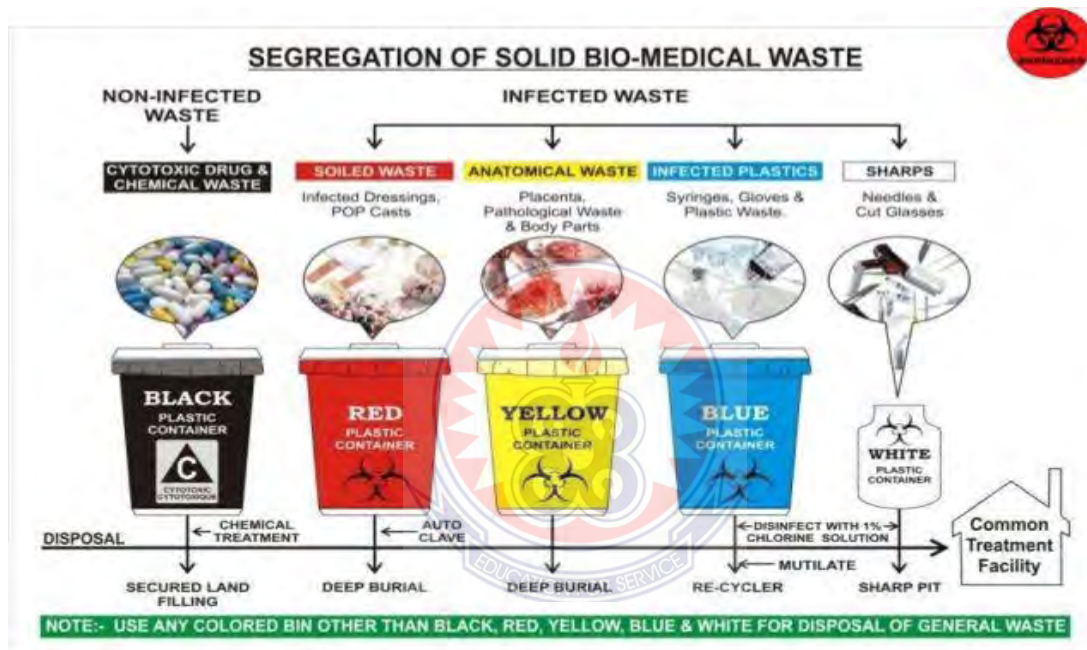


Figure 2.2 Segregation of Waste, (Source, WHO 2020)

2.9 Collection and Transportation of Medical Waste

Collection of waste involves the mobilizing and gathering of waste after collection to the point where the collection vehicle is emptied (MOH, 2020). Waste generated at health facilities must be hauled at regular intervals within the day and must not over stay where it is generated. It is therefore the responsibility of each health facility to develop a comprehensive waste management program aimed at daily collection and transportation of

waste (Taslimi *et al.*, 2020). In the health facility setting, the transportation of waste is usually in two phases, the first phase has to do with the transporting of waste from the source of generation to a temporal storage system on the premises of the health facility. The second phase deals with the transportation of waste from the temporal storage system within the health facility to an offsite treatment and disposal plant (Wu *et al.*, 2020). As far as possible, the means used for transporting waste must be reserved for that purpose and different means must be used for each type of waste (MOH, 2020). These transportation systems must have easy system of uploading of waste, labeled appropriately and such vehicles must be kept clean all the time (Tabrizi *et al.*, 2018). It must however be noted that many countries across the world transport their waste in uncovered vehicles and also with bear hands which have serious health implications (Liu *et al.*, 2020). The problem with this is that, the medical waste collected by the waste collection service providers are not transported, processed and disposed of appropriately according to international standards.

2.10 Treatment and Disposal of Healthcare Waste

In recent years, most especially developing countries are battling to select the best medical care waste (MCW) disposal technique for the effective treatment of the medical waste during especially COVID-19 era. In developing countries like China, ineffective medical waste treatment methods and poor waste dumping techniques are often employed (Thakur and Ramesh, 2017). Treatment of waste has to do with rendering of waste safe for disposal which must follow the Environmental Protection Agency regulations and guidelines. It is a method which involves the change of the biological composition of waste (Wiafe *et al.*, 2015). World Health Organization (2019) indicated that the proportion of health care

facilities that did not use appropriate waste disposal methods ranged from 18 % to 64 %. According to the WHO, thousands of HIV infections and millions of cases of hepatitis could have been avoided yearly if proper disposal methods were adhered to (WHO, 2020). The following treatment or disposal techniques are commonly used for medical waste disposal: incineration technology, non-incineration technology, autoclaving, microwave irradiation, chemical methods, plasma pyrolysis and sanitary landfills and burning in an open space (Manupati *et al.*, 2021; Cook Ed *et al.*, 2020). Incineration is one of the most widely used disposal methods for medical waste (WHO, 2020). It involves using a high temperature (800–1100 degrees Celsius) and a dry oxidation process. Medical care waste incineration can employ one of three basic incinerator types: These are; Double-chamber incinerators which are often designed for infectious MW; Single chamber incinerators, not as widely employed, Rotary Kilns which can be used on genotoxic waste and heat resistant chemicals.

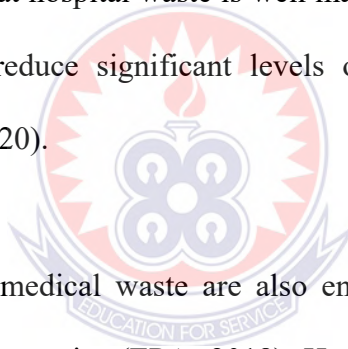
Incineration can be broadly applied to Medical care waste as it can be utilized on both hazardous and non-hazardous waste (Kenny *et al.*, 2021) but cannot be applied to pressurized gas containers, silver salts, reactive chemicals, waste high in mercury or cadmium, halogenated plastics or sealed ampoules. This method can be fueled by wood, gas or electricity. Incineration and sanitary landfills are the most common methods for medical waste management worldwide (Hong *et al.*, 2018) continues to be the preferred choice of healthcare waste treatment (Liu *et al.*, 2018; EPA, 2020). It must however be noted that if an institution or country decide to use incineration as treatment options then practical steps must be put in place to regulate the level of emissions in order to reduce exposure of risk to waste workers and the environment which is usually a problem for most developing

countries (Narayamoorthy *et al.*, 2020). Open burning of healthcare waste also leads to emissions of harmful gases to the environment (Aung *et al.*, 2019). Another method of waste treatment is by the non-incineration technique which involves rendering waste safe by destroying pathogens which are capable of transmitting diseases to humans and potential effects on the environment through biological, chemical, irradiation and thermal means. (WHO, 2020). Autoclaving is also another method employed in the treatment of waste which involves the use of steam at great temperatures to destroy all microorganisms in the waste (Rozeck *et al.*, 2019). Microwave irradiation method cannot be left out in the treatment of hospital or health care waste. The chemical method involves the use of chemicals powerful enough to kill pathogens in waste generated from health institutions e.g. Hypochlorite solution. Sanitary land filling involves digging and burying of waste or closing up of waste with soil. This aids in the reclamation of land for agricultural or other land use purposes. This method of waste disposal can be said to be one of the oldest system in the management of waste and it is widely or mostly used by many developing nations with financial and technological challenges (Puopiel, 2010). A survey conducted in Ghana in 2013 to assess healthcare waste management (HCWM) situations in healthcare facilities in Ghana showed that waste management practices were below acceptable standards and posed risk to staff and communities (UNDP & MOH, 2014). This triggered the review of the 2006 policy guidelines in Ghana in January 2020.

2.11 Medical Waste Management in Developed Nations

Countries worldwide are struggling to develop strategies and infrastructure for appropriate disposal of the increasing medical waste generated in health facilities across the world

(Narendra, *et al.*, 2021). The management of hospital waste largely depends on the implementation of waste legislations, dedicated allocation of budget towards waste management, segregation of waste at point of generation and the use of environmental friendly technologies for the treatment of hospital waste (Asante *et al.*, 2014). In advanced nations there exist appropriate laws governing the operations of the medical waste management system (Gupta *et al.*, 2020). Some of these international laws include color coding all medical waste bins. There also exist appropriate technologies which are considered among the best practices in the treatment and safe disposal of medical waste. Some of these technologies include high grade incineration. A study in most hospitals in the developed nations revealed that hospital waste is well managed and measures are also being put in place to drastically reduce significant levels of pollution as a result of waste incineration (Andrea *et al.*, 2020).



Laws and regulations on biomedical waste are also enforced to help improve the waste management system in these counties (EPA, 2018). Health institutions in Canada are now moving away from on-site incineration of healthcare waste to a central location where waste from several health institutions could be incinerated in order to reduce the pollution levels in the country (Dzekasu, 2017). This also has low-cost financial implication for the effective and efficient management of health care waste. It must however be noted that many countries in the developed nations could have saved a lot of money through proper waste segregation but this is not so due to low priority given to health care waste management issues (Yhang *et al.*, 2021). The waste management system in the area of storage, transportation and disposal are still a great challenge for most developed nations (WHO,

2018). Continuous capacity building for staff is also still a challenge (Zamparas *et al.*, 2019; Fitria *et al.*, 2017; Qiufeng *et al.*, 2018). These practices are not different from what pertains in most developing countries of the world.

2.12 Medical Waste Management in Developing Countries

The global health challenges of medical care waste disposal strategies often differ depending on how developed a country is. (Kenny *et al.*, 2021). In developing countries, hospital waste management have not received the needed attention it deserves and still remains a major challenge (Odonkor *et al.*, 2020). This can be as a result of scarce resources with competing demands. It is estimated that approximately 282, 447 tons of healthcare waste are generated from an estimated 67, 740 health facilities in Africa (AGENDA, 2017; Udofia & Nriagu, 2013). Studies indicate that Africa is not prepared to handle the quantum of waste being generated and most often waste could be seen dumped openly without being treated (WHO, 2019; Saad, 2013). It must also be noted that though there has been increasing awareness on solid medical waste management by individual countries in Africa, the total picture of solid waste management is still unclear (Udofia *et al.*, 2015).

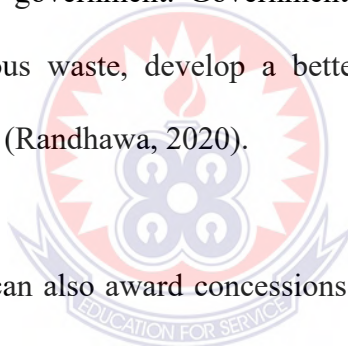
Findings in developing countries on medical wastes management indicated that, waste was not segregated at the point of generation, stored in appropriate colour coded containers, treated and disposed of in a safe and proper manner. The challenges in Africa in the area of medical waste management can largely be attributed to a number of factors including poor infrastructure and lack of awareness of the health risk associated with medical waste by stakeholders involved in all waste management issues in their respective countries. In

Kenya, most medical care waste is disposed together with municipal waste and they use common methods such as open burning and burying in the disposal of waste. The country has beautiful laws on health care waste management but due to lack of a dedicated budget, monitoring often becomes a great challenge (Othigo, 2014). A study in South Africa revealed that management of health care waste was problematic as health facilities had no waste management policies, plans and a dedicated waste management team (Othigo, 2014). The study further revealed that some African countries met to see the way forward in the area of medical waste management since it was becoming a challenge in order to come out with solutions in tackling the situation in a holistic manner. They further noted that awareness on issues of proper medical waste management practices were generally lacking among waste workers. Also, a study carried out in the Tamale metropolis in Ghana revealed that most of the hospitals lack the capacity to effectively manage their waste due to the absence of incinerators and other waste management resources. Openly burning of waste was carried out on the premises of the hospitals (Hussein *et al.*, 2014). It is however worth noting that a study (Udofia *et al.*, 2015) on the compliance of African countries on WHO standards on waste management indicated that in the area of waste segregation and final disposal most African countries were now adhering to standards. This practice is similar to what pertains in most of the developed nations of the world.

2.13 Private Sector Involvement in Medical Waste Management

The worldwide governments can invite the private investments in medical waste management by adopting Public Private Partnership (PPP) model to develop better healthcare infrastructure and ease out the financial burden on the government (Song *et al.*,

2017). Healthcare services are responsible to manage medical waste they generate, of which majority of them fail to do that effectively which leads to the pollution of the environment and also poses threat to public health through such waste (Kennedy Degaulle, 2018). Contracting out involves the award of a contract to the private sector for the delivery of services such as cleaning of hospital surroundings and the management of disposal sites, through government investment policies in the development of a sustainable healthcare waste management system like: PPP (Public Private Partnership) model, BOT (Build Operate Transfer) projects (Song *et al.*, 2017). This is usually done when due procurement processes have been followed and the private sector is mandated to go strictly according to the laid down policies of the government. Government investment policies with the PPP model for managing infectious waste, develop a better infrastructure for infection free treatment of healthcare waste. (Randhawa, 2020).



The state or health facilities can also award concessions to private investors to establish or set up facilities for health care waste management using state or health institution's resources. For instance, the establishment of a central treatment plant for hospital waste management to take care of health facilities at one geographical place or region. In line with government policies in creating an enabling environment for waste service delivery in Ghana, more than 80% of waste management service delivery in the country are now handled by the private sector (Agyepong, 2010). This has seen Zoomlion Ghana Limited a leading waste management company in the country engaged in various waste management activities. The company was established in 2006 with the ultimate aim of using simple but modern methods and technologies in the effective management of waste in the country. The

company offer services such as cleaning and landfill management (Boamah, 2011). Hospitals in Ghana are responsible for solid waste generated and are encouraged to engage the services of private waste management companies in the management of their hospital waste (MOH, 2020). This has seen the Mampong municipal hospital and Agona SDA hospital engaging the services of Zoom Lion Ghana Limited in the management of some aspects of their waste in the area of hauling of waste to their respective landfills.

2.14 Ghana Health Service Policy Guidelines on Healthcare Waste Management

2.14.1 Medical Waste Management policy and Legal Context

National legislations are vital for the effective management of waste in any country. It establishes the legal frame work and allows the national agency responsible for waste management to effectively see to the smooth implementation of the law which should spell out the policy document and technical guidelines for the effective management of waste. In Ghana, the Environmental Protection Agency (EPA) and the Ministry of Local Government and Rural Development (MLGRD) have the responsibility of enforcing waste management regulations. This mandate is carried out through the auspices of the office of the Environmental Protection Agency (EPA) and the Metropolitan, Municipal and District Assemblies (MMDA's), which are directly under the EPA and MLGRD respectively. They are expected to collaborate with health institutions in finding comprehensive ways in the management of waste generated by these institutions because there are no specific provisions in the law, which assigns or accord health institutions clear roles in dealing with hospital waste. The Ministry of Health developed the Ghana Health Service policy document and technical guidelines on hospital waste management (MOH, 2020). It must

however be noted that despite this policy document, there exist a gap between the law and policy hence there is no specific comprehensive national legislations on the handling of hospital waste even though, some institutions are assigned functions on waste management under the laws of the county. Each health institution or facility therefore has the oversight responsibility of taking necessary steps in ensuring the smooth implementation of the waste management process (MOH, 2020).

2.15 Medical Waste Management Plans and Policies in Ghana

Health institutions are expected to develop waste management plans and policies, which will guide their operations in the management of waste generated as a result of their activities. However, many countries lack the utilization of proper policies and plans for municipal solid waste including medical waste (Godini *et al.*, 2021). Every good medical waste management system in a hospital depends on a dedicated waste management team, good administration, careful planning, sound organization, underpinning legislation, adequate financing and above all the full participation by trained staff (WHO, 2020; ICRC, 2011). A study conducted by Akum (2014) at the Bawku Presbyterian Hospital of the Upper East Region of Ghana also recommended the formation of a dedicated committee on medical waste management and ensuring regular meetings of the working committee. Different countries have different guidelines and plans for handling medical waste, and most require some type of treatment to minimize exposure of the general public, the problem areas are similar for all healthcare units and all stages of management (Shaيدا *et al.*, 2019). Those responsible for hospital waste management, especially the hospital manager, should inform the medical staff of their responsibility for the implementation of the plan for the general

separation of infectious waste and their proper storage. (Ahmad Badeenezhad, 2021). Since 2006, healthcare waste management (HCWM) policy guideline has been in place to direct the management of healthcare waste throughout its lifecycle in the health sector. Although, this has resulted in some improvement in health care waste management there were still challenges with the implementation of the policy (MOH, 2020).

2.16 Training and Education on Medical Waste Management

Consistently giving education and training to all health care workers as well as external service providers, such as orderlies, on the operation guidelines of medical waste management. Imani (2016) will immensely reduce the high risk associated with medical waste and public health. But the lack of education and training (knowledge) and awareness among healthcare workers on handling of medical waste is greatly hampering it (Singh *et al.*, 2021). Medical Waste is not disposed of in the appropriate methods as a result of enormous network of factors such as lack of education and training (Kenny *et al.*, 2021).

Training of healthcare and waste management staff in acceptable standard for the management of medical waste is essential for strengthening the capacity of the general health workers in effective management of medical waste generated in the health facilities as well as to mitigation of health and occupational risk (WHO, 2020). Education and training fundamentally are required to bring change of behavior towards the handling of medical waste. Health workers should be trained to be exposed to the right measures to manage medical waste. Training guidelines should be revisited from time to time and must include knowledge in: basic processes in medical waste management; content on knowledge through

in-service training; Medical Waste (MW) management policy; roles and responsibilities of healthcare workers and waste handlers and risks associated with Medical Waste management. This could be attained by public engagements, meetings, conferences, workshops, and training courses on the challenges of the negative effects of poorly managing medical waste (Odonkor *et al.*, 2021). Causes should be made mandatory for healthcare professionals to equip them with the general principles and practices of medical waste management techniques.

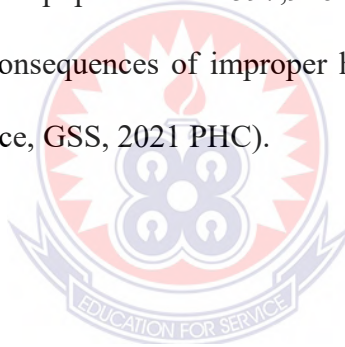


CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study was conducted in health facilities (Health Centers, District Hospitals, Poly-Clinics) in the Sekyere enclave of Ashanti Region of Ghana. Specifically, the Sekyere enclave comprises seven (7) municipals and districts with health facilities (including health centers, district hospitals and private health facilities). These Municipalities and Districts include; Mampong-Municipal, Sekyere Kumawu, Sekyere Afram Plains, Ejura-Sekyedumasi Municipal, Sekyere Central, Sekyere South and Sekyere East (Figure 3.1). This study area has a projected population of 597,916 people who can be exposed either directly or indirectly to the consequences of improper handling of medical waste in these areas. (Ghana Statistical Service, GSS, 2021 PHC).



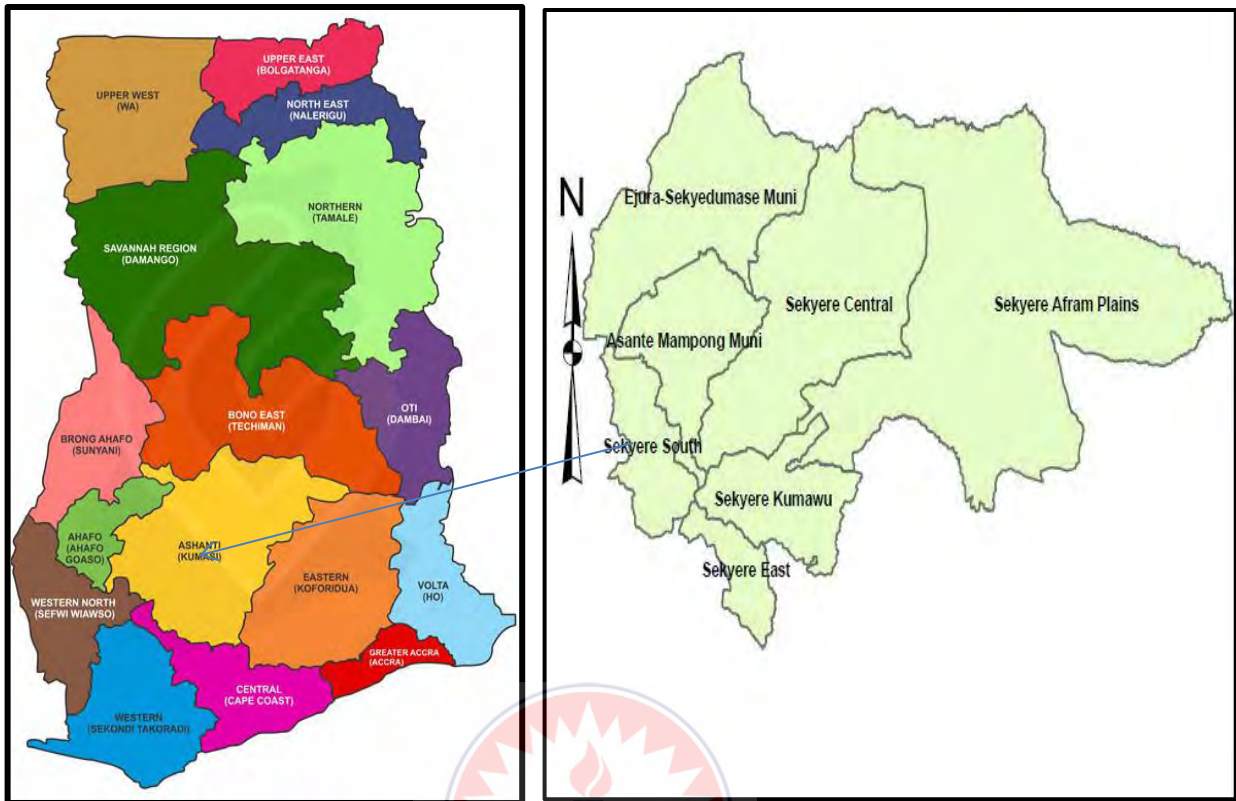


Figure 3.1: The map of Ashanti Region showing Sekyere Enclave

3.1.1 Location of the Study

The Ashanti Region is located south of Ghana and is third largest of 16 administrative regions occupying a total land surface of 24,389 km² (9,417 sq. mi) or 10.2 per cent of the total land area of Ghana. In terms of population, however, it is the second most populous region according to the provisional data of the 2021 census with a population of 4,780,380 accounting for 19.4 % of Ghana's total population. The Ashanti Region has latitude 5 °C 26 59.99” N and longitude 0°C 56, 59.99E.

3.1.1.1 Mampong Municipal

Mampong municipal which forms part of the Sekyere enclave, is located north-east of Kumasi, the Ashanti regional capital is bounded to the north by Atebubu District, the Ahafo region east by Sekyere Central, south by Sekyere South and Ejura-Sekyedumasi to the west, the municipality is partly situated on the Mampong scarp which runs eastwards. Mampong Municipal has a population of 88,051 people according to the 2021 population census (PHC, 2021). The municipality has a sex ratio of 94. The female population in the municipality is 51.6 percent while the male's ratio constitutes 48.4 %.

3.1.1.2 Ejura-Sekyedumasi Municipal

Ejura-Sekyedumasi is located in the northern part of the Ashanti region, now shares borders with Atebubu-Amantin district in the north-west, Mampong-municipality to the east, South district to the south and the Offinso Municipal Assembly to the west. Ejura-Sekyedumasi is among the least populous municipalities in Ashanti Region with a population of 85,446. The population distribution by sex indicates that the male population is 42,892 and the female population was 42,554. The sex distribution of the population was fairly even across the younger age groups in the municipality.

3.1.1.3 Sekyere Kumawu District

Sekyere Kumawu district is located between 0°N 20 North and longitudes 0°W 45 and 1°W 15 west. The district shares boundaries with Sekere-Central district to the west, Sekyere East and Asante- Akim North Districts to the south and Sekyere Afram Plains District to the east. Kumawu the capital is about 54 kilometers north-east of Kumasi, the capital of Ashanti

Region. The Sekyere Kumawu District has a population of 65,5052 of which females are 52.6 % and males 47.4 %. The proportion of the population in rural locality is 52.8 % which is higher than the proportion in urban locality 47.2 %.

3.1.1.4 Sekyere South District

The Sekyere South district (formerly of Afigya Sekyere district) is located in the north eastern part of the Ashanti Region. Agona -Ashanti, the administrative capital, is location 37 kilometers away from Kumasi, along the Kumasi Mampong trunk road. The district shares common boarders with Ejura-Sekyedumasi, Mampong-Municipal and Sekyere East to the east, Kwabere East to the south and Offinso Municipal to the west. The Sekyere South District has a population of 94,009, out this figure 44,691(46.5 %) are males while the remaining 49,318 (52.5 %) are females. The share of the population among urban and rural localities are 50,118 (53.5) and 43,891(46.7 %) respectively. The district sex ratio is 90.6 percent meaning that for every 100 females in the district there are about 91 males. The ratio however, changes at age 20 years and above.

3.1.1.5 Sekyere Afram Plains District

The Sekyere Afram Plains district is located at north-eastern part of Ashanti region and lies between latitudes 0 °C20 and 1 °C2 north and longitudes 6 °C52 and 7 °C32 west. The district covers an estimated land area of 3,525.1 square kilometer representing 14.5 % of the regional land size of 24,389 square meters. The district shares boundaries with the Sekyere-Kumawu, the Sekyere- South, Sekyere- Central district to the west and Asante -Akyem North district on the south west. It also shares boundaries with the Kuwawu Afram Plains

North district in the eastern region to the south east. It bounded by the Atebubu-Amantin district on the north west and Sene East and Sene West district in the Ahafo region to the north and north east respectively. The district capital Drobonso is accessible by road. The results of the 2020 PHC shows that, the total population of the Sekyetre Afram plains district is 32,535, representing about 6.0 percent of the Ashanti regions population. The population is made up of 15,184 males (53.2 %) and 13,351 females (46.8 %). The district is entirely rural settlement. The population density of the district is currently 8.1 persons per square kilometer which is lower than the regional average of 196 persons per square kilometer.

3.1.1.6 Sekyere Central District

The Sekyere- Central District which is one of the (30) administrative district in the Ashanti region of Ghana, it is located on the northern part of the region, and shares boundaries' with Mampong-Municipal, Atebubu District, Sekyere East, Sekyere South and Ejura-Sekyedumasi. The land size of the district is 1,631.1sq. kilometers and it is located within longitude 0.05 °C and 1.30 °C west and latitudes 6.55 °C and 7.30 °C north. The district is located in the north eastern part of Ashanti region, approximately between latitudes 6 °C45-6 °C55 north and longitude 1 °C15-1 °C25 west. It shares boundaries' with Sekyere-Kumawu District to the northeast, Asante Akyem Central Municipal to the south east, Ejisu- Juaben Municipal to the south west, Sekyere-South District to the west and Asante Akyem north district to the east. It covers an estimated land area about 239.1 sq. kilometers and has about 42 major settlements of varying size. The Sekyere Central District has a population of 71,232, distributed as 35,2256 males (49.5 %) and females (50.5 %). Majority of the

population reside in the rural areas (48,666) than urban areas (22,566). More than half (52.3 %) of the population in the district fall in the age category of 0-19 years. The sex ratio of the district is 97:8 which means that in every 98 males there are 100 females. Apart from the age groups 0-4, 10-14, and 15-19 where the sex ratio is 100 (more males than females), all other age groups recorded a sex ratio of less than 100 (more females than males) (PHC, 2021).

3.1.1.7 Sekyere East District

The Sekyere East District was created in 1988 and is one of the 30 districts in the Ashanti Region of Ghana. It has Effiduase as the district capital. Located in the north-eastern part of the region, it lies approximately between Latitude 6° 45' - 7° 32' North and Longitude 0° 22' West. It shares boundaries with the Sekere Kumawu District to the North-East, Asante-Akim Central Municipal to the South East, Ejisu-Juaben Municipal to the South-West, Sekyere South District to the West and Asante-Akim North District to the East. It covers an estimated land area of about 239.1 square kilometers and has about forty-two (42) major settlements of varying sizes. The Sekyere East has a total population of 6,172 accounting for 1.3 % of the Ashanti regional population of 4, 780,280. The female population is 32,661 which forms 52.5 % of the district's population as against the main population of 29,511 constituting 47.5 %. This translates into a sex ratio of 90.4 meaning there are 90 males to 100 females in the district. More than half of the population 33,620 (54.1 %) resides in the urban areas compared to 28, 552 (35.9 %) in the rural areas. The results of the 2021 population and housing census showed that the total population of the district is 28,535, representing about 6.0 % of the Ashanti region's population. The population is made up of

15,145 males (53.2 %) and 13,351 females (46.8 %) The population density of the district is currently 8.1 persons per sq. kilometer which is lower than regional average of 196 persons per sq. kilometers. Almost a half (45.9 %) of the population is aged 0-19 years. In general, there are more males than females in the district and this runs through all the age groups with an exception of the age group 20-21 and 90 – 99 years where females out-number males.

3.1.2 Climate

The study areas have general climatic condition that conform to the general conditions that prevail within the middle belt in Ghana. The districts experience monthly mean temperature around 26 °C, although some areas record lower figures. Maximum temperature is between 29 °C and 31 °C in march and April, while minimum temperatures of 21 °C and 23 °C are experienced in August. Double maximum rainfall is experience annually. The major season start in April and ends in July, while the minor season begins in September and ends in early November. June is the wettest month of the year. Humidity is higher during the wet month of the year and low during the dry month. Relative humidity within the districts averaged about 80 % (Population and Housing Census, PHC 2021).

3.2 Data Collection

3.2.1 Study Design

Descriptive cross-sectional study was used to assess management practices of medical waste among health facilities and workers. The study was hospital based cross-sectional study designed to examine management of medical waste in health facilities in the Sekyere

enclave of Ashanti region in Ghana. The study employed both quantitative and qualitative procedures to assess the generation, segregation, storage, treatment, transportation and disposal of solid and liquid waste in the health facilities. The study also obtained data from workers in the health facility units such as the pharmacy, mortuaries, wards and laboratory.

3.2.2 Quantitative Study

The quantitative part of this study employed structured and semi structured questionnaires to solicit the views on waste management practices and operations among healthcare workers and sanitary staff in the health facilities in the Sekyere enclave. The data collected included information on the hospital waste management system, knowledge, attitudes and perception of staff, healthcare workers and unit heads on waste management, waste policies and plans of the health facilities. Records at the waste management units at health facilities was extracted using an excel data sheet were used as part of data collection.

3.2.3 Qualitative Study

The qualitative study sought to know the inherent challenges and opportunities that existed in the management of medical waste in the study facilities. In-depth interviews were used to gather information from the management of the facilities while non-participant observations were used to gather information about the operational practices carried out at the health facilities.

3.2.4 Study Population

The target population included all healthcare workers such as the environmental health workers, doctors, nurses, pharmacist, laboratory technicians, pathologist and mortuary attendants etc., in the Public health facilities in the Sekyere enclave of Ashanti Region. These people were purposively selected because they contribute to the generation of medical waste in the health facilities and have specific knowledge relating to healthcare waste management. They all contribute to the waste generation and therefore have roles to play in the management issues in the health facilities.

3.2.5 Samples Size Estimation

A total of 1733 healthcare workers were estimated for the study. Using the Slovin scientific method of sample estimation i.e. $n = \frac{N}{1+Ne^2}$ with a design error of 5 %.

Where: n = number of samples, N = Total population of healthcare workers in the Sekyere enclave = 1733, e = error term = 5%,

$$n = \frac{1733}{1+1733(0.05)^2} = 325$$

Hence, a sample size of 325 was estimated for this study. The sample size for each facility was based on proportion to population size.

Table 3.1: The Selected Health Facilities within the Sekyere Enclave

No.	Name of Health Facility	Population	Sample Size
1.	Mampong Hospital	403	70
2.	Ejura Hospital	354	56
3.	Effiduase Hospital/Devine Health Center	293	55
4.	Agona S.D.A /Agona Hospital	290	58
5.	Kumawu Polyclinic	103	46
6.	Drobonso Health Center	187	20
7.	Nsuta Health Center	103	20
		Total:1733	Total: 325

3.2.6 Sampling Techniques

Public health facilities were selected using purposive sampling technique. All district/municipal hospitals were selected and where there was no hospital, a health center was selected. Seven (7) public health facilities at the districts/ municipals and two health centers from Sekyere South district and Sekyere East district were used. These health facilities were the sites where field surveys were carried out (Table 3.1).

A total of 325 respondents were selected from all the selected health facilities. The number of study participants for each health facility were selected based on proportion to population size. The respondents that were selected from the various units within the health facilities included the environmental health workers, doctors, nurses, orderlies, pharmacist, pathologist, environmental sanitary staff and mortuary attendants etc. These groups of people were conveniently selected from the various units of the health facilities because they are the available respondents who are engaged in waste generation the health facilities

3.2.7 Data Collection Procedures

Data was obtained from both primary (questionnaires, personal observations, and an in-depth -interviews) and secondary data (records) sources. The wards and units that were visited included the environmental Health unit, physiotherapy, surgical wards, laboratory, pharmacy, mortuary and OPD because, they contribute to the waste generated at these health facilities.

3.2.7.1 Data Collection and Study Instruments

These study instruments below were employed to collect data to achieve the stated objectives of the study,

- i. A semi-structured questionnaire was designed to capture study variables covering broad themes (4) sections (A= Knowledge Attitudes, and Perception of Healthcare Staff, B =Waste Generation, Segregation and Storage, C = Health and Safety Issues with Healthcare Waste, and D = Waste Transport and Disposal) including Socio-Demographic Characteristics.
- ii. In-depth interview.
- iii. Personal Observation. (Transect walk, Direct surveillance)

3.2.8 Data Collection Process

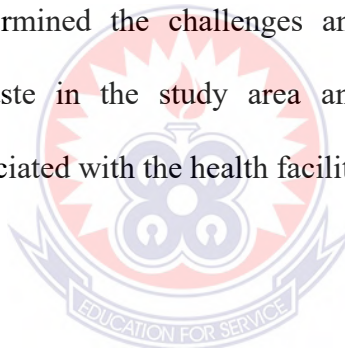
3.2.8.1 Semi-structured Questionnaire Administration

Face-to-face interviews were employed to gather data from the administrator, matron, pathologist and environmental health officers so as to increase the response rate. But in a

situation where a respondent was willing to self-administer the questionnaire, they were included. Others included waste handlers and healthcare personnel such as laboratory technicians, administrators, doctors, nurses, mortuary attendants, environmental sanitary staff etc.

3.2.8.2 In-depth Interviews

In-depth interviews were used to solicit information on waste management practices and operations from the environmental health officers in charge of waste management, administrators, medical superintendents, accountants, human resource officers etc., The information from these determined the challenges and opportunities that exist in the management of medical waste in the study area and the related environmental and occupational health risks associated with the health facilities.



3.2.8.3 Personal Observation

Personal observation was adopted to gather information on the existing management practices of medical waste in these health facilities within the study area. The composition of medical waste was determined. Photographs of some existing practices was taken and documented. In addition, observational check list was employed to gather enough information on the management practices of the medical waste in the hospitals within the Sekyere enclave. Observation of waste segregation at source, waste bins labels, storage, transportation, treatment and disposal, the use of personal protective equipment's [PPE] by the waste handlers was carried. The walls and notice boards were observed for healthcare waste management posters on public education. Temporal storage and disposal sites on the

premises of the hospital was visited. In the process, pictures were taken in these hospitals, clinics and other health centers with the help of a camera of any heaps of medical waste on-sites, waste containers overflowing, scattered hospital waste on the premises of the health facility and inappropriate content of waste containers in order to complement the quantitative data. All these observations were carried out to find out if the health facilities follow laid down rules and regulations as spelt out in the Ministry of Health policy guidelines on healthcare waste management.

Table 3.2: Departmental Units Officers in the Health Facilities Interviewed

Name Of Health Facility	Environmental Health Officer	Pathologist	Hospital Matron	Administrator	Total Number
Mampong Hospital	1	1	1	1	4
Ejura Hospital	1	1	1	1	4
Effiduase Hospital	1	1	1	1	4
Agona Hospital	1	1	1	1	4
Agona S.D.A Hospitals	1		1	1	4
Kumawu Polyclinic	1	1	1	1	4
Devine Health Center	1	1	1	1	4
Drobonso Health Center	1	1	1	1	4
Nsuta Health Center	1	1	1	1	4

3.2.8.5 Field Survey

Objective 1: To evaluate the existing structures and operational practices of medical waste management practices in health facilities and among healthcare workers. Data was gathered by employing the use of personal observation at various study areas, and an in-depth

interview (IDI). For healthcare workers, semi-structured questionnaire (self-administered) was used to collect information on the operational practices of the health facilities of medical waste management. Pictures were taken on-site to ensure prove of the operational practices and the existing structures at the health facilities.

Objective 2: To determine the challenges and opportunities that exist in the management of medical waste. Here, Semi-structured questionnaire was employed to gather additional information for the analysis of the data gathered. Waste handlers who could not do self-administration of the questionnaire were given assistance. Again, an in-depth -interview was purposively conducted with administrative staff of the health facilities such as environmental health officers, nurse's matron, hospital administrator and pathologist.

Objective 3: Assess the knowledge, attitudes, risk and perceptions among healthcare workers on medical waste management. Data for this objective was gathered with the use of well-structured questionnaire (open and close ended questions) and in-depth interview to ascertain whether the health personnel have adequate information on the risk involved in the handling of the medical waste in the health facilities. Some of the respondents engaged in self-administration of the questionnaire while those who could not read to understand the questionnaire were given assistance. Face-to-face interview was conducted with the heads of the various units at the health facilities to validate the data gathered.

Objective 4: To assess management practices of mortuary wastes generated. To achieve this, an on-site observation was done based on the Ministry of Health Waste Management

recommendation guidelines (MOH, 2020) to gather on-site information. The observations focused on the types of waste generated at the mortuary. Assistance was given to respondents to administer questionnaires to gather data on the management practices of waste generated at the hospitals with mortuary unit. Pictures were taken from sites where waste was disposed with a help of a camera. Face-to-face interview was carried out with the various pathologists of the hospitals to ensure accurate data was obtained.

3.3 In-depth Interviews

A well-structured interview guide was employed to gather the data. In doing so, there was limitation in the various health professionals that were interviewed. They included; the administrator, matron, pathologist, the environmental health officer in charge of sanitation issues in the hospitals and the medical superintendent. In the absence of the unit's heads, their deputies stood in to be interviewed. After these health professionals had given their consent to be interviewed, a tape recorder was used to record their opinions and was later transcribed verbatim in a written form. This provided the window to tabulate and summaries participants' responses.

3.4 Quantitative Data Management and Analysis

All administered questionnaire was checked for completeness, accuracy and consistency of the responses and was entered into Microsoft Excel software version 2010. The data was exported to Statistical Package for Social Sciences (SPSS) software for Windows, Student Version 20. Preliminary descriptive and inferential statistical analysis was carried out to further clean the data of errors and also ensure data completeness, accuracy and consistency

of the responses. Descriptive and inferential statistics was performed and data presented in the form of analysis of variance (ANOVA) as well as tables, cross tabulations and percentages for the sake of clarity of presentation.

3.4.1 Qualitative Data Analysis

Qualitative data obtained was summarized and described using Qualitative Data Analysis instruments such as narrative and content analytical tools.

3.4.2 Non-Participatory Observation

Personal observation was used to gather data. There was guided form to help the researcher to be able to have a well tabulated data. The data was then analyzed by using frequency and as well as percentage tabulations. This was done in line with the stated objectives.

3.5 Quality Control

To ensure reliability and adequacy of the questionnaire, the questionnaire was pre-tested by using the Quality Health Clinic and Calvary Health Clinic at Mampong-Ashanti, which is not included in the study. The pre-test sites were chosen due to their close proximity to the study area. The participants understood the instrument; however, some complained of the many items on the questionnaire, which took much of their time. Elements of the questionnaire were changed in order to standardize it for use in the study.

3.6 Ethical Considerations

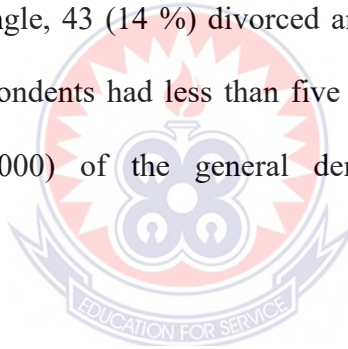
Ethical clearance for the study was obtained from the University of Education, Winneba Committee on Human Research, Publications and Ethics (CHRPE) and Ghana Health Service (GHS). In addition, clearance and permission was obtained from the Ashanti regional Director, Health Services of Ghana. Permission from the respective Heads of the health facilities was also sought. Written informed consent was obtained from participants.



CHAPTER FOUR

RESULTS

The demographic characteristics of respondents showed that, majority 225 (75 %) were females while 75 (25 %) were males. Majority of the respondents had age ranged 30-39 years 114 (38 %). This was followed by 20-29 years 79 (26 %), 40-49 years 48 (16 %), below 20 years 42 (14 %) and 50 and above years 17 (6 %) respectively. The entire respondents had received formal education. Those who received tertiary education were 186 (62 %) followed by Junior High School level of education 34 (11 %), primary education 31 (10 %) and Senior High School /O'level 26(9 %). The results showed 130 (43 %) were married, 108 (36 %) were single, 43 (14 %) divorced and 19 (6 %) separated. The results indicated 111 (37 %) of respondents had less than five years work experience. There was significant difference ($P=0.000$) of the general demographic characteristics of the respondents (Table 4.1).



4.1 Bio Data of Respondents

Table 4.1: Bio Data of Respondents

Study parameter	Frequency (F)	Percentage (%)	P-value
Sex			
Female	225	75	0.000
Male	75	25	
Age (years)			
<20	42	14	0.000
20-29	79	26	
30-39	114	38	
40-49	48	16	
≥50	17	6	
Education			
Tertiary	209	70	0.000
SHS/O'Level	26	9	
JHS/Middle form	34	11	
Primary	31	10	
Marital Status			
Married	130	43	0.000
Single	108	36	
Divorced	43	14	
Separated	19	6	
Work Experience(years)			
<5	111	37	0.000
6-10	93	31	
11-15	72	24	
16-20	24	8	
Profession			
Nurse	130	44	0.000
Midwife	63	21	
Lab Technician	10	3	
Eye Specialist	4	1	
Pharmacist	9	3	
Psychiatrist	7	2	
Administrators	9	3	
Doctors	18	6	
Orderlies	50	17	

4.2 Existing Structures and Operational Practices of Medical Waste Management at Health Facilities

4.2.1 Types of Waste Generated at Health Facilities

Medical waste generated were generally grouped into hazardous and non-hazardous waste. According to the respondents, hazardous and non-hazardous waste were generated at the health facilities. 263 (35.54 %) of respondents indicated both hazardous and non-hazardous waste were generated at the health facilities. 257 (34.7 %) of respondents said hazardous waste and non-hazardous waste 220 (29.73 %). There was no significant difference ($P=0.868623$) for the types of waste generated at the health facilities (Table: 4.2).

Table 4.2 Medical Waste Generation at the Health Facilities

Medical Waste	Hazardous	Non-hazardous	Both	P-Value
FACILITY	n(%)	n(%)	n(%)	
Mampong Municipal Hospital	58(7.80)	53(7.20)	59(8.00)	
Ejura Municipal Hospital	74(10.00)	59(8.00)	73(9.90)	
Effiduase District Hospital	13(1.80)	13(1.80)	12(1.60)	
Agona District Hospital	22(3.00)	12(1.60)	24(3.20)	
Agona SDA Hospital	21(2.80)	12(1.60)	23(3.10)	
Kumawu polyclinic	19(2.70)	19(2.70)	19(2.70)	
Divine Grace Health Center	12(1.60)	13(1.80)	14(2.0)	
Drobonso Health Center	16(2.20)	17(2.30)	18(2.40)	
Nsuta Health Center	22(3.00)	22(3.00)	21(2.80)	
Total	257(34.00)	220(29.70)	263(35.60)	0.868623

4.2.2 Existing Structures in the Health Facilities

The study showed 8 out of the 9 healthcare facilities surveyed had an incinerator installed for burning infectious waste. These were Agona Hospital, Mampong Hospital, Kumawu Polyclinic, Nsuta Health Center, Ejura Hospital, Drobonso Health Center, Effiduase Hospital and Divine Health Center. The only exception was Agona S.D.A hospital with a broken incinerator. For those health care facilities surveyed with incinerators, the waste incinerators installed were in full operation. All of the incinerators surveyed had chimneys without air pollution control devices (APCDs) mounted. Burning infectious waste into ash was done and the ash produced was added to the general waste containers for disposal. Some of the health facilities had dump site for final disposal of their waste. Among the health facilities which did not have waste pit included Mampong, Ejura, Kumawu, Devine, and Drobonso health facilities. From personal observation made during the visit the management of these structures were fairly effective except few instances where open burning was carried out.

Table 4.3: Existing Structures in the Health Facilities

FACILITY	Waste Pit	Dumping site	Incinerator
Mampong Hospital	No	Yes	Yes
Ejura Hospital	No	Yes	Yes
Effiduase Hospital	Yes	Yes	Yes
Agona Hospital	Yes	Yes	Yes
Agona SDA Hospital	No	Yes	No
Kumawu Polyclinic	No	Yes	Yes
Devine Health Center	No	Yes	Yes
Drobonso Health Center	No	Yes	Yes
Nsuta Health Center	Yes	Yes	Yes

4.2.3 Medical Waste Segregation and Storage

The study showed that all the health facilities practiced source segregation of their waste. According to the results, the respondents indicated that, 268 (89 %) of the healthcare facilities had plastic bin with lid for keeping waste as being segregated while 32 (11 %) had metal waste bin with lid. From observation, all units at health facilities had waste bins for collecting waste. The compounds were mounted with adequate waste bins which was collected on frequent basis without spillage of waste.

Table 4.4 Medical Waste Segregation and Storage

HCW	plastic bin with lid	metal waste bin with lid	Total
FACILITY	n(%)	n(%)	n(%)
Mampong Municipal Hospital	53(18.00)	12(4.00)	65(2.20)
Ejura Municipal Hospital	74(25.00)	10(3.00)	84(28.00)
Effiduase District Hospital	12(4.00)	1(0.00)	13(4.00)
Agona District Hospital	33(11.00)	(0.00)	33(11.00)
Agona SDA Hospital	29(10.00)	(0.00)	29(10.00)
Kumawu polyclinic	18(6.00)	2(1.00)	20(7.00)
Divine Grace Health Center	12(4.00)	3(1.00)	15(5.00)
Drobonso Health Center	17(6.00)	2(1.00)	19(6.00)
Nsuta Health Center	20(7.00)	2(1.00)	22(7)
Grand Total	268(89.00)	32(11.00)	300(100)

4.2.4 Means of Transporting Stored Medical Waste

The study showed means of transporting waste were done outside health facilities and within the health facilities by tricycles and hand/bags. The respondents indicated 142 (47 %) of the health facilities used both means of transporting waste to the final disposal site. The study revealed 108 (36 %) of the respondents indicated transportation by hand and polythene bags as means of waste transport while 50 (17 %) of the respondents both means of transport. The health facilities as observed by the researcher showed the facilities employed trucks to collect waste outside the health facilities, specifically mentioned was Mampong Hospital. There was no significant difference ($P=0.084735$) for means of waste transport of waste in health facilities (Table 4.5).

Table 4.5: Means of Transporting Stored Medical Waste

Means of transport	Both	Tricycle	Bags/hand	Total
FACILITY	n(%)	n(%)	n(%)	n(%)
Mampong Hospital	28(9.00)	13(4.30)	24(8.00)	65(22.00)
Ejura Hospital	40(13.00)	10(3.40)	34(1.10)	84(28.00)
Effiduase Hospital	6(2.00)	4(1.40)	3(1.00)	13(4.00)
Agona Hospital	17(6.00)	1(0.3.00)	15(5.00)	33(11.00)
Agona SDA Hospital	16(5.00)	0(0.00)	13(4.00)	29(10.00)
Kumawu Polyclinic	8(3.00)	7(2.40)	5(2.00)	20(7.00)
Divine Health Center	8(2.00)	4(1.40)	3(1.00)	15(5.00)
Drobonso Health Center	10(3.00)	4(1.40)	5(2.00)	19(6.00)
Nsuta Health Center	9(3.00)	7(2.40)	6(2.00)	22(7.00)
Grand Total	142(47.00)	50(17.00)	108(36.00)	300(100)

4.2.5 Method of Medical Waste Disposal

The study showed that, final waste disposal was burning and landfill sites. The respondents indicated burning 117 (39 %) was the final means wastes were disposed. The results recorded landfill 99 (33 %) and both burning and landfill 84 (28 %). There was no significant difference ($P=0.677833$) for healthcare waste final disposal (Table 4.6).

Table 4.6: Method of Medical Waste Disposal

Treatment	Both	Burning	Landfill	Total	P-value
FACILITY	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	17(6.00)	22(7.00)	26(9.00.)	65(22.00)	
Ejura Hospital	23(8.00)	37(12.00)	24(8.00)	84(28.00)	
Effiduase Hospital	6(2.00)	3(1.00)	4(1.00)	13(4.00)	
Agona Hospital	8(3.00)	17(6.00)	8(3.00)	33(11.00)	
Agona SDA Hospital	9(3.00)	14(5.00)	6(2.00)	29(10.00)	
Kumawu polyclinic	6(1.10)	7(2.00)	8(3.00)	20(7.00)	
Divine Health Center	5(2.00)	4(1.00)	6(2.00)	15(5.00)	
Drobonso Health Center	7(2.00)	4(1.00)	8(3.00)	19(6.00)	
Nsuta Health Center	4(1.00)	9(3.00)	9(3.00)	22(7.00)	
Grand Total	84(28.00)	117(39.00)	99(33.00)	300(100)	0.677833

4.3 Challenges and Opportunities that Exist in the Management of Medical Waste in the Sekyere Enclave

4.3.1 Causes of Poor Healthcare Waste Management Practices

The study showed that challenges of healthcare waste management were inadequate containers, inadequate education, amount of fee charged on waste disposal and distance to waste disposal sites. Majority of the respondents 253 (38.90 %) indicated inadequate

containers was the major cause of poor healthcare waste management and has become a major problem to the health facilities. About 219 (33.80 %) of the respondents indicated inadequate education on health care waste management. The amount of fee charged on waste disposal recorded 175 (27 %) and distance to waste disposal site recorded 2 (0.30 %). There was significant difference ($P=0.00051$) on causes of poor healthcare waste management among the various health care facilities (Table 4.6).

Table 4.7: Challenges of Healthcare Waste Management

FACILITY	Inadequate containers n(%)	Inadequate education n(%)	Fee Charged n(%)	Disposal site distance n(%)	Total n(%)	P- value
Mampong Hospital	54(8.30)	50(7.70)	48(7.40)	1(0.15)	153(23.55)	
Ejura Hospital	71(11.00)	63(9.00)	49(7.70)	0(0.00)	183(27.70)	
Effiduase Hospital	13(2.00)	12(1.90)	11(1.70)	0(0.00)	36(5.60)	
Agona Hospital	27(4.20)	17(2.60)	6(0.90)	1(0.15)	51(7.85)	
Agona SDA Hospital	22(3.40)	17(2.00)	5(0.70)	0(0.00)	44(6.10)	
Kumawu Polyclinic	17(2.60)	17(2.60)	17(2.60)	0(0.00)	51(7.80)	
Divine Health Center	13(2.00)	9(1.40)	8(1.20)	0(0.00)	30(4.60)	
Drobonso Health Center	16(2.50)	14(2.20)	11(1.70)	0(0.00)	41(6.40)	
Nsuta Health Center	19(2.90)	20(3.10)	20(3.10)	0(0.00)	59(9.10)	
Total	252(38.90)	219(33.80)	175(27.00)	2(0.30)	648(100)	0.0051

4.3.2 Consequences of Improper Medical Waste Management

The study showed perceived consequences of poor medical waste management were environmental pollution and outbreak of diseases. The respondents, 226 (51%) indicated

environmental pollution was the chief consequence of poor health care waste management which affect public health. Outbreak of diseases 220 (49%) was another consequence of poor healthcare waste management. There was no significant difference ($p=0.9394$) on consequences of poor health care waste management among the various healthcare facilities. (Table: 4.7).

Table 4.8: Consequences of Improper Medical Waste Management

Challenges of poor MWM Facility	Environmental pollution n(%)	Outbreak of disease n(%)	Total n(%)	P-value
Mampong Hospital	46(10.40)	51(11.40)	97(21.80)	
Ejura Hospital	66(14.90)	59(13.10)	125(28.00)	
Effiduase Hospital	66(14.90)	9(2.00)	75(28.00)	
Agona Hospital	24(5.40)	21(4.00)	45(9.20)	
Agona SDA Hospital	23(5.20)	18(4.00)	41(9.20)	
Kumawu polyclinic	15(3.40)	17(3.80)	32(7.20)	
Divine Health Center	9(2.00)	13(2.90)	22(4.90)	
Drobonso Health Center	14(3.10)	14(3.10)	28(6.20)	
Nsuta Health Center	17(3.80)	18(1.00)	35(4.80)	
Total	226(51.00)	220(49.00)	446(100)	0.9394

4.3.3 Environmental Pollution Associated with Poor Healthcare Waste Management

According to the respondents, environmental pollution is seen as littering on the compound or choked gutters. The respondents indicated, littering on the compound 233 (55%) was the highest form of environmental pollution, followed by choke of gutters 189 (45%). There was

significant difference (p-0582327) on environmental pollution at the healthcare facilities (Table 4.8).

Table 4.9: Environmental Pollution Associated with Poor Healthcare Waste

Management

Environmental pollution Facility	Littering n(%)	Choked gutters n(%)	Total n(%)	P-value
Mampong Hospital	52(12.30)	43(10.20)	95(22)	
Ejura Hospital	69(6.30)	54(12.90)	123(19.2)	
Effiduase Hospital	11(2.50)	9(2.10)	20(4.60)	
Agona Hospital	23(5.40)	18(4.20)	41(9.60)	
Agona S.D.A Hospital	21(5.00)	17(4.00)	38(9.00)	
Kumawu Polyclinic	14(3.30)	14(3.30)	28(6.60)	
Divine Health Center	11(2.50)	8(1.90)	19(4.40)	
Drobonso Health Center	15(3.50)	10(2.40)	25(5.90)	
Nsuta Health Center	17(4.00)	16(3.80)	33(7.80)	
Total	233(55.00)	189(45.00)	422(100)	0.0582327

4.3.4 Problems Associated with Management of Medical Waste

The study showed reported cases of accidents/injuries were mainly identified. The main challenge as indicated in the study was lack of enough funds to procure adequate personal protective equipment's (PPEs) and other waste management tools to ensure effective management of waste. The study also showed most of the sanitary workers were not paid duly in the month as casual workers due to inadequate funds. This challenge according to the health administrators was hampering effective management of waste in the facilities.

There was also inadequate sanitary workers/environmental health officer in the health facilities. The study showed that none of the health facilities had permanent environmental health officers employed by Ministry of Health, (Ghana). The facilities administrators in most instances doubled as the environmental officers of the hospitals. Specifically mentioned include Kumawu, Agona and Drobonso health facilities. The study showed that, education and training on medical waste management was not frequently organized for health workers and the entire sanitary staff as scheduled by the health facilities internal plan, which is supported by Ministry of Health Policy guidelines on medical waste management and World Health Organization (WHO) benchmark or standards (Table 4.9).

Table 4.10: Challenges in Management of Medical Waste

Healthcare facility	Reported cases of accidents/injuries in handling HCW	Workforce in HCWM	Have enough funds for HCWM
Mampong Hospital	Needle pricking	Inadequate Sanitary Staff and Education on HCWM	No
Ejura Hospital	Needle Pricking		No
Effiduase Hospital	Needle Pricking	√	No
Agona Hospital	Needle Pricking	√	No
Agona S.D.A Hospital	Needle Pricking	√	No
Kumawu Polyclinic	Needle Pricking	√	No
Divine Health Center	Needle Pricking	√	
Drobonso Health Center	Needle Pricking	√	No
Nsuta Health Center	Needle Pricking	√	No

4.3.5 Opportunities in the Management of Medical Waste

According to the health administrators, and medical superintendent from the various health facilities, gloves, apron, boot, goggles, uniforms, face and nose masks were the commonest PPEs used by the workers for managing waste and these were effectively used. Procedures for waste collection and handling were the same throughout the health facilities as observed by the researcher which was in consistence with (Kenny *et al.*, 2020). These procedures include waste generation, segregation of the waste into color coded containers, collection of the waste by the waste handlers, storage, transportation and final disposal. There were waste treatment systems and structures put in place for final disposal. These structures include dump sites, waste pit, and incinerators for burning infectious waste at very high temperature. Waste segregation was done in all the facilities at point of generation. This was ascertained through an in-depth interview and observation conducted throughout the study. In all these, the study showed that, health workers stand to benefit immensely if proper structures are put in place to well manage medical waste (Table 4.10).

Table 4.11: Opportunities in the Management of Medical Waste

Healthcare facility	PPES	Effective usage of PPE	Procedures for collection, storage and handling	Waste treatment system	Segregating waste
Mampong Hospital	Gloves, apron, boot, goggles, uniforms, face and nose mask	effective	Generation, segregate, collection, storage transport, dispose	Yes	Yes
Ejura Hospital	√	None effective	√	Yes	Yes
Effiduase Hospital	√	Very effective	√	Yes	Yes
Agona Hospital	√	√	√	Yes	Yes
Agona S.D.A Hospital	√	√	√	Yes	Yes
Kumawu Polyclinic	√	√	√	Yes	Yes
Devine Health Center					
Drobonso Health Center	√	√	√	Yes	Yes
Nsuta Health Center	√	√	√	Yes	Yes

4.3.6 Benefits of Adherence to Medical Waste Policy Regulation

Reduced accidents, reduced cost of compensation to injured, reduced death of staff were identified as benefits of proper adherence to medical waste policy regulation in management of waste. The respondents who indicated reduced cost of compensation to the injured were 235 (27 %), reduced accidents 221 (26 %), reduced deaths of staff 216 (25 %) and labor turnover 185 (22 %). There was no significant difference ($p=0.931786$) among the hospitals in respect of benefits of proper healthcare waste management. (Table: 4.11).

Table 4.12: Benefits of Adherence to Medical Waste Policy Regulation

	Reduced accident	Reduces compensation	Reduction of death	Labor turnover	Total	P-value
FACILITY	n(%)	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	54(6.40)	58(6.70)	56(6.50)	47(5.60)	215(25.20)	
Ejura Hospital	59(6.90)	62(7.10)	58(6.70)	52(6.20)	231(26.90)	
Effiduase Hospital	11(1.30)	11(1.30)	9(1.00)	8(1.80)	39(5.40)	
Agona District Hospital	15(1.80)	17(2.00)	15(1.70)	14(1.60)	61(7.10)	
Agona SDA Hospital	18(2.10)	17(2.00)	14(1.60)	11(1.30)	60(7.00)	
Kumawu Polyclinic	17(2.00)	19(2.20)	18(2.10)	15(1.70)	69(8.00)	
Divine Health Center	12(1.40)	14(1.60)	13(1.50)	10(1.20)	49(5.70)	
Drobonso Health Center	14(1.60)	15(1.70)	12(1.40)	11(1.30)	52(6.00)	
Nsuta Health Center	21(2.50)	22(2.50)	21(2.40)	17(2.00)	81(9.40)	
Total	221(26.00)	235(27.00)	216(25.00)	185(22.00)	857(100)	0.931786

4.3.7 Diseases Arising from Poor Medical Waste Management

The study showed related diseases of poor healthcare waste management were malaria, cholera and diarrhea. Majority of the respondents indicated cholera 237 (33.70 %) was the main disease resulting from poor healthcare waste management. Malaria 236 (33.50%) whiles diarrhea was 231 (32.80 %). There was no significance difference (P=0.9969) of respondent's answers in respect to related diseases of poor healthcare waste management (Table: 4.12).

Table 4.13: Diseases Arising from Poor Medical Waste Management

	Malaria	Cholera	Diarrhea	Total	P-value
Facility	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	57(8.10)	54(7.70)	53(7.50)	164(23.30)	
Ejura Hospital	65(9.20)	64(9.10)	64(9.10)	193(27.40)	
Effiduase Hospital	11(1.60)	11(1.60)	13(1.80)	35(5.00)	
Agona Hospital	20(2.80)	21(2.0)	18(2.60)	59(7.40)	
Agona SDA Hospital	15(2.10)	20(2.80)	18(2.60)	53(7.50)	
Kumawu polyclinic	19(2.70)	18(2.60)	17(2.40)	54(7.70)	
Divine Health Center	14(1.90)	13(1.80)	13(1.80)	40(5.50)	
Drobonso Health Center	15(2.10)	16(2.30)	17(2.40)	48(6.80)	
Nsuta Health center	20(2.80)	20(2.80)	19(2.70)	59(8.30)	
Total	236(33.00)	237(33.70)	231(32.80)	704(100)	0.09969

4.4 Knowledge, Attitudes, Risk and Perceptions among Medical Care Workers on Medical Waste Management

4.4.1 Sources of Knowledge on Medical Waste Management

Knowledge in healthcare waste management among medical care workers was assessed and the results revealed that all of the respondents had knowledge on healthcare waste. On the source of knowledge, 105 (35 %) of the respondents had their source of information from ministry of health training. Eighty-five 85 (28.33 %) said they had their knowledge from the educational institutions they attended. Radio and television were 60 (20 %) and 50 (16.67 %) respectively. There was no significance difference (P=0.2614) on the source of knowledge of the various healthcare facilities (Table 4.13).

Table 4.14: Sources of Knowledge on Medical Waste Management

Source of information	Educational Institution	MOH Training	Radio	Television	Total	P-value
FACILITY	n(%)	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	17(5.67)	19(6.33)	17(5.67)	12(4.00)	65(21.67)	
Ejura Hospital	28(9.33)	27(9.00)	15(5.00)	14(4.67)	84(28.00)	
Effiduase Hospital	4(1.33)	2(0.67)	2(0.67)	5(1.67)	13(4.33)	
Agona Hospital	11(3.60)	18(6.00)	2(0.67)	2(0.67)	33(11.00)	
Agona SDA Hospital	10(3.33)	16(5.33)	1(0.33)	2(0.67)	29(9.67)	
Kumawu Polyclinic	3(1.00)	6(2.00)	6(2.00)	5(1.67)	20(6.67)	
Divine Health Center	2(0.67)	5(1.67)	5(1.67)	3(1.00)	15(5.00)	
Drobonso Health Center	6(2.00)	5(1.67)	5(1.67)	3(1.00)	19(6.33)	
Nsuta Health Center	4(1.33)	7(2.33)	7(2.33)	4(1.33)	22(7.33)	0.2614
Grand Total	85(28.33)	105(35.00)	60(20.00)	50(16.67)	300(100.00)	

4.4.2 Officers Responsible for Ensuring Proper Medical Waste Management

Respondents indicated medical waste management was the responsibility of several people in the healthcare facility. As high as 251 (26.30 %) respondents indicated healthcare waste management was the responsibility of the administrative head of the health facilities. This was followed by doctors 244 (25.50 %), nurses 239 (25.20 %). There was no significance difference ($P=0.9883$) in the responses on the one responsible for healthcare waste management of various healthcare facilities. (Table: 4.14).

Table 4.15: Officers Responsible for Ensuring Proper Medical Waste Management

HWM	Health Admin	Doctors	Orderlies	Nurses	Total	P-value
Facility	n(%)	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	54(5.60)	56(5.80)	57(6.00)	57(6.00)	224(23.40)	
Ejura Hospital	73(7.70)	68(7.10)	59(6.20)	64(6.80)	264(27.80)	
Effiduase Hospital	13(1.40)	13(1.40)	13(1.40)	12(1.30)	51(5.50)	
Agona Hospital	24(2.50)	18(1.90)	10(1.00)	15(1.50)	67(6.90)	
Agona SDA Hospital	23(2.40)	19(2.00)	11(1.10)	15(1.50)	68(7.00)	
Kumawu polyclinic	17(1.80)	19(2.00)	19(2.00)	20(2.10)	75(7.80)	
Divine Health Center	10(1.00)	12(1.00)	13(1.40)	15(1.50)	50(4.90)	
Drobonso Health Center	16(1.70)	17(1.70)	18(1.90)	19(2.00)	70(7.30)	
Nsuta Health Center	21(2.20)	22(2.30)	22(2.30)	22(2.30)	87(9.10)	
Total	251(26.30)	244(25.50)	222(23.20)	239(25.00)	956(100)	0.9883

4.4.3 Healthcare Staff Priority towards Medical Waste Management

On healthcare waste as a priority to healthcare staff at the hospitals, all the respondents responded positively to that. The priority given to medical waste management at health facilities were judged by the respondents as follows; 297 (34.70 %) said this was mostly seen in training of health workers in waste management, 187 (21.80 %) said budgeting for waste collection and disposal while 186 (21 %) indicated provision of waste storage materials. There was no significant difference ($P=0.4679$) for the priority of waste management in healthcare facilities of the various healthcare facilities (Table 4.15).

Table 4.16: Healthcare Staff Priority of Medical Waste Management

Priority of waste management	Training HCW in WM	Waste Management in budget	Waste Storage Materials	Maintenance of waste disposal site	Total	P-value
FACILITY	n(%)	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	64(7.50)	51(5.90)	52(6.00)	52(6.00)	219(25.40)	
Ejura Hospital	82(9.60)	51(5.90)	50(5.80)	47(5.50)	230(26.80)	
Effiduase Hospital	13(1.50)	13(1.50)	13(1.50)	13(1.50)	52(6.00)	
Agona Hospital	33(3.90)	3(0.30)	3(0.30)	3(0.30)	42(4.80)	
Agona SDA Hospital	29(3.40)	2(0.20)	1(0.10)	1(0.10)	33(3.8)	
Kumawu Polyclinic	20(2.30)	18(2.10)	18(2.10)	20(2.30)	76(8.80)	
Divine Health Center	15(1.80)	12(1.40)	12(1.40)	13(1.50)	52(6.10)	
Drobonso Health Center	19(2.20)	16(1.90)	16(1.90)	16(1.90)	67(7.90)	
Nsuta Health Center	22(2.60)	21(2.40)	21(2.40)	22(2.60)	86(10.00)	
Total	297(34.7)	187(21.8)	186(21.7)	187(21.8)	857(100)	0.4679

4.4.4 Source of Information on Medical Waste Management Policy Regulations

The respondents indicated source of information on healthcare waste regulations were from administration and television. The results showed that the main sources were from television 349 (56 %) and administration 275 (44 %). There was no significant difference (P=0.545971) for source of information on healthcare waste regulations. (Table: 4.17)

Table 4.17: Source of Information on Medical Waste Management Policy Regulations

HCW	Administration	Television	Total	P-value
FACILITY	n(%)	n(%)	n(%)	
Mampong Hospital	56(9.00)	96(15.40)	152(24.40)	
Ejura Hospital	73(11.70)	100(16.00)	173(27.70)	
Effiduase Hospital	13(2.10)	11(1.80)	24(3.90)	
Agona Hospital	31(5.00)	17(2.70)	48(7.70)	
Agona SDA Hospital	28(4.50)	17(2.70)	45(7.20)	
Kumawu Polyclinic	20(3.20)	33(5.30)	53(8.50)	
Divine Health Center	15(2.40)	23(3.70)	38(6.10)	
Drobonso Health Center	18(2.90)	20(3.20)	38(6.10)	
Nsuta Health Center	21(3.40)	32(5.10)	53(8.50)	
Total	275(44.00)	349(56.00)	649(100)	0.545971

4.4.5 Risk Associated with Medical Waste Storage

The study showed that risk associated with healthcare waste storage were diseases, cuts and needle pricking. The respondents 262 (47 %) who indicated diseases were the major challenges affecting health workers was the highest, followed by needle pricking with 190 (34 %) while cut also followed with 103 (19 %). There was no significant difference among the facilities ($P=0.048734$) for risk associated with healthcare waste storage. (Table:4.18)

Table 4.18 Risk Associated with Medical Waste Storage

FACILITY	Contraction of disease	Cut	Needle pricking	Total	P-value
	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	56(10.00)	20(3.80)	50(8.90)	126(22.70)	
Ejura Hospital	71(12.70)	9(1.70)	25(4.80)	105(19.20)	
Effiduase Hospital	7(1.30)	13(2.30)	13(2.30)	33(5.90)	
Agona Hospital	33(5.90)	7(1.30)	20(3.70)	60(10.90)	
Agona SDA Hospital	29(5.20)	6(1.10)	18(3.20)	53(9.50)	
Kumawu Polyclinic	19(3.40)	20(3.80)	19(3.40)	58(10.60)	
Divine Health Center	14(2.50)	10(1.80)	13(2.30)	37(6.60)	
Drobonso Health Center	14(2.50)	11(2.00)	17(3.00)	42(7.50)	
Nsuta Health Center	19(3.40)	7(1.30)	15(2.70)	41(7.40)	
Total	262(47.00)	103(1.90)	190(34.00)	555(100)	0.048734

4.4.6 Safety Measures and Practices in Medical Waste Management

Safety measures employed in healthcare waste management were several. The respondents indicated using protective clothing 272 (30 %), proper waste management as part of orientation on first employment 230 (25 %), regular monitoring on safety and health standards 210 (23 %) and retraining on safety and health practices 203 (22 %). There was no significant difference ($P=0.839822$) for safety measures and practice in medical waste management (Table 4.19).

Table 4.19: Safety Measures and Practices in Medical Waste Management

FACILITY	orientation on first employment	monitoring on safety and health	Using protective clothing	Re-training on safety and health	Total	P-value
	n(%)	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	57(6.20)	56(6.10)	60(6.60)	56(6.10)	229(25.00)	
Ejura Hospital	59(6.40)	54(5.90)	75(8.30)	52(5.60)	240(26.20)	
Effiduase Hospital	12(1.00)	13(1.40)	13(1.40)	13(1.40)	51(5.20)	
Agona Hospital	15(1.60)	7(0.80)	27(3.00)	5(0.50)	54(5.90)	
Agona SDA Hospital	14(1.50)	6(0.70)	23(2.50)	3(0.30)	46(5.00)	
Kumawu Polyclinic	20(2.20)	20(2.20)	20(2.20)	20(2.20)	80(8.80)	
Divine Health Center	15(1.60)	15(1.60)	15(1.60)	15(1.60)	60(6.40)	
Drobonso Health Center	17(1.80)	18(2.00)	18(2.00)	18(2.00)	71(7.80)	
Nsuta Health Center	21(2.20)	21(2.30)	21(2.30)	21(2.30)	84(9.20)	
Total	230(25.00)	210(23.00)	272(30.00)	203(22.00)	915(100)	0.839822

4.4.7 Safety Inspection done on Medical Waste Management

The respondents indicated safety inspection of handling medical waste was carried out in various healthcare facilities. These included waste collections 279 (58 %), waste separation 2 (2 %) and waste transport 197 (42 %). There was significant difference ($P=0.002277$) for safety inspection of healthcare waste storage. (Figure: 4.20)

Table 4.20s: Safety Inspection done on Medical Waste Management

FACILITY	Waste collection	Separation	Transport	Total	P-value
	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	62(12.80)	1(0.50)	51(10.60)	114(23.90)	
Ejura Hospital	80(16.60)	0(0.00)	51(10.60)	131(27.20)	
Effiduase Hospital	13(6.00)	0(0.00)	12(2.50)	25(8.50)	
Agona Hospital	29(6.00)	1(0.00)	7(1.50)	37(7.50)	
Agona SDA Hospital	25(5.20)	0(0.00)	8(1.70)	33(6.90)	
Kumawu Polyclinic	19(3.90)	0(0.00)	19(3.90)	36(7.80)	
Divine Health Center	13(2.70)	0(0.00)	14(2.90)	27(5.60)	
Drobonso Health Center	17(3.50)	0(0.00)	16(3.30)	33(6.80)	
Nsuta Health Center	21(4.40)	0(0.00)	19(3.90)	40(8.30)	
Total	279(58.00)	2(2.00)	197(41.00)	478(100)	0.002277

4.4.8 Health and Safety Training in Managing Medical Waste

The study showed that health and safety training in managing waste was carried out at health facilities. The respondents indicated proper usage of safety materials 285 (39 %), safety measures to be observed 226 (31 %) and proper waste management 223 (30 %) as some of the training curricular/courses. There was no significant difference ($P=0.722767$) for health and safety training in managing healthcare waste. (Table: 4.21).

Table 4.21: Health and Safety Training in Managing Medical Waste

	usage of safety materials	Safety measures to observed	Proper waste management	Total	P-value
FACILITY	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	59(8.10)	59(8.10)	57(7.30)	175(23.50)	
Ejura Hospital	77(10.50)	59(8.10)	60(8.10)	196(26.70)	
Effiduase Hospital	13(1.80)	12(1.60)	11(1.50)	36(4.90)	
Agona Hospital	32(4.40)	11(1.50)	13(1.70)	56(7.60)	
Agona SDA Hospital	29(4.00)	11(1.50)	13(1.70)	53(7.20)	
Kumawu Polyclinic	20(2.70)	20(2.70)	19(2.60)	59(8.00)	
Divine Health Center	15(2.10)	15(2.10)	14(1.90)	48(6.10)	
Drobonso Health Center	19(2.60)	18(2.50)	16(2.20)	53(7.30)	
Nsuta Health Center	21(2.00)	21(2.90)	20(2.60)	62(7.50)	0.722767
Total	285(39.00)	226(31.00)	223(30.00)	734(100)	

4.5 Management Practices of Mortuary Waste Generated in Health Facilities

4.5.1 Management Practices of Mortuary Waste

The study revealed only three of the health facilities surveyed have mortuary facilities. These mortuary facilities had no adequate waste management structures such as dumping site, enough waste bins, and incinerators installed for mortuary waste management. The health facilities with mortuary facilities included Mampong hospital, Effiduase hospital and Agona S.D.A hospital. The study found that, mortuaries generated waste such as, used gloves, cloths of dead persons, sharps, pathological waste, liquid waste etc. From observation made during the study and as validated by the respondent's response, waste segregation was not done but rather combined and disposed together which clearly did not follow standard practice. The respondents indicated that, pathological waste such as tissues

and organs were sutured together after autopsy. The study showed that, a measurable quantity of between 5ml to 8ml of formalin depending on the weight and size of a dead person is added to the body before taken out of the facility for final burial. This was made known by an in-depth interview throughout the study. The blood that was collected through embalmment and autopsy was flushed into the sewage system so that it could be treated. From observation, the sewage systems were well designed and maintained to ensure public and environmental safety. The study revealed, workers in these various mortuaries were aware of medical waste management regulations policy document. However, they did not have a copy to guide their practices and handling of the waste they generated at the mortuaries. The mortuaries lacked permanent environmental health officers and orderlies to facilitate their work effectively. Wastes were not segregated at the point of generation but rather put together and later sent to the municipal waste site for final disposal.

4.5.2 Management of Solid Mortuary Waste

The study revealed that, management practices of solid mortuary waste was different from liquid waste. From observation, solid medical waste was not handled and treated with the required accepted standard practice. This was established by an in-depth observation done at the premises of these mortuary facilities. The observation revealed that, solid waste such as cloth and dresses of the dead persons were burnt openly at the premises of the mortuaries together with general medical waste which potentially become a threat to public health and largely a threat to the environment.

4.5.3 Management of Liquid and Organic Mortuary Waste

The study revealed that, liquid waste was generated daily at these mortuary facilities due to the number of dead bodies received daily. However, liquid waste produced depended on the type of dead bodies. The respondents indicated that, dead bodies that were treated at the mortuary facilities with accident injuries and with a lot of blood stains used much volumes of water than bodies that are received through natural death. The study showed that Mampong mortuary received on daily basis an average of two dead bodies of persons at the facility, Effiduase mortuary received an average of one body daily and Agona S.D.A one body on each day. The study showed that, waste generated as a result of treating dead bodies was virtually the same. The respondents indicated that, after dissection, waste water was usually reused for cleaning surfaces where dead bodies were treated. It was observed that, mortuaries discharged their liquid waste water into the general sewage system and these systems are well built. The situation was very common to all the surveyed mortuaries within the study area.

Table 4.22: Management Practices of Mortuary Waste Generated

FACILITY		Dumping site	Incinerator	Segregation	waste management
Mampong Municipal Hospital	No	No	No	No	No
Effiduase District Hospital	No	No	No	No	No
Agona SDA Hospital	No	No	No	No	Tissues and organs are treated with chemicals.

CHAPTER FIVE

DISCUSSION

5.1 Background Characteristics

The need for effective management of medical waste as a means of safeguarding health worker's safety and prevention of undue outbreak of diseases cannot be over looked. This study found out that majority of sampled medical facilities did not have medical waste disposal guidelines. This is a reflection of poor attitudes by healthcare service providers towards the management of their healthcare waste. Several previous studies have indicated unethical conducts by healthcare facilities in their waste disposal activities (Keche, *etal.*, 2020). Many researches have similarly decried poor coordination and persistent dormancy of institutional frameworks for the management of healthcare waste in Ghana (Hussein *et al.*, 2014 and Imani Africa, 2016), However, healthcare facilities neglect their responsibilities of ensuring stringent penalties to serve as deterrent for defaulters. Imani Africa (2019) reported that, in a survey of a tertiary health facility in Accra, it was found that the hospital did not have waste management manuals. Possession of healthcare waste manuals will assist designated staff members to understand the procedures for treating different components of waste products that are generated from healthcare centers.

5.2 Existing Structures and Operational Practices of Medical Waste Management

Practices in Health Facilities and among Healthcare Workers

5.2.1 Existing Structures for Medical Waste Management at Health Facilities

According to Adu *et al.* (2020), close to 90% of healthcare facilities in the capital regions of Ghana do not sort their waste. This was different from this study where all health facilities

sorted their waste at the point of generation. This study demonstrated that, 8 out of the 9 healthcare facilities surveyed had an incinerator installed for burning infectious waste. Incinerators were used by the health facilities, although the standard for protecting the environment from pollution thereof should be ensured. This is consistent with the study conducted by Rosek, *et al.*, 2019, who indicated that, among the various health facilities surveyed, all had incinerators without pollution control devices fixed on these incinerators. All these incinerators were functional except only one health facility, however, these incinerators were overstretched and operated above their capacity.

The study showed that, all health facilities have pathological pits in place to keep safe any health risk from tissues, infectious blood, saliva etc., this is in consistence with Priadarshini *et al.* (2021), whose study revealed that all the health facilities surveyed in their study had pathological pit for treating and disposal of body tissue and other amputated organs. From an in-depth observation, not all the placenta pits in the health facilities meet international and national specifications. It was again observed that, three of the nine facilities visited had open fire waste pit where non-infectious waste was burnt thereby compromising human health and safety as a result of associated environmental pollution. Several organizations including the World Health Organization (WHO) and Ghana's Environmental Protection Agency (EPA) as well as Health Care Without Harm (HCWH) recommends proper technology as a method for the treatment of medical waste (Asante *et al.*, 2014). Figure 5.1 shows placenta pit at Agona SDA hospital and a waste pit that was used to burn medical waste after final disposal to the site.



Figure 5.1: Placenta Pits Present at different Health Facilities

5.2.2 Operational Practices of Medical Waste Management at Health Facilities

Medical waste management in health facilities faces the risk of cross contamination from the lack of thorough sorting of the waste at the points of generation (Adu *et al.*, 2020). The study showed that, in the Sekyere enclave, health facilities visited resorted to segregation of their waste at the point of generation. This was consistent with the study conducted by Cook *et al.* (2020) who reported that all hospitals that were surveyed appreciably segregated their waste. As they do this, the infectious waste fraction sorted will still end up at the landfill sites, mixed with the general municipal waste. This was so well consistent with Adu *et al.* (2020) who's study in the Tamale Teaching Hospital showed medical waste generated at the hospital ended up being disposed with the municipal solid waste. In considering this, when infectious waste is mixed with general municipal waste, it must all be considered infectious (WHO, 2018). The study revealed that, some of the facilities in the Sekyere enclave are benefiting from the communal collection system spearheaded by a private company, Zoomlion Ghana limited on behalf of the municipal assemblies and some health facilities. This revelation is consistent with a study that was conducted by Khan *et al.* (2017) which stated that, medical waste could be given out to some private companies to manage it. From observation, the company collected and mixed the non-hazardous waste with the hazardous

waste from the health facilities and sent them to the central disposal sites. However, in some cases, medical waste was burnt openly without any form of protection in an open burning pit. Specifically, Figure 5.2 shows that Agona hospital and Effiduase hospital resorted to an unprotected open burning of both sharps and other general wastes. It should also be noted that, three of the health facilities sampled were health centers, therefore, the volume of waste that would be generated from many of such health centers would be low, thereby facilitating their safety management.



A: Agona SDA Hospital

B: Effiduase Hospital

Figure 5.2: MWM Practices Present at Agona Hospital

5.2.3 Medical Waste Management Practices among Healthcare Staff

The study aimed at understanding management of healthcare waste and associated factors among health workers in the Sekyere enclave. The study revealed that, many of the health workers believed, strict enforcement of the Ministry of Health medical waste policy regulation will be essential for proper healthcare waste management. The respondents recommended strict enforcement; adding that this has to be complemented with continuous training. This can be backed by a study conducted by Mannocci *et al.* (2020) whose results indicated that, training and education were the tool to bring change of behavior in the

management of medical waste by health staff. Wearing personal protective equipment (PPE) such as gloves masks, clinical coats, shoes would help to minimize exposure to infections and injuries. In this study, it was revealed that, health workers wore appropriate personal protective equipment (PPE) which is good practice since it could minimize risk of contact with the waste. This was consistent with Sangkham *et al.* (2020) study that showed that wearing nose mask could protect the health staff from infections. Generally, the practice of health workers on health care waste management was satisfactory which relates to appreciable knowledge that these health workers have according to an in-depth observation carried out on the field. An exception occurred in a few instances where infectious waste generated at the health facilities at Ejura hospital were mixed up with the non-infectious waste at some of the wards where waste is both generated by patients and the health workers (Figure 5.3). This was attributed to the low training of some patients and their caretakers.



Figure 5.3: Waste Segregation practices at Ejura hospital

5.3 Challenges and Opportunities that Exist in the Management of Medical Waste

5.3.1 Challenges Identified in Managing Medical Waste at Health Facilities

While visiting the nine health facilities in the study, it was observed that, even though medical waste sorting at the points of generation was fairly practiced, the study revealed

that, safe management was still a challenge by the lack of consistent color coding for separate waste types. Thus, the effective management of medical waste should begin at source (the wards and units) and continue through the secondary stage at the hospital premises (Adu *et al.*, 2020). In all, segregation was mostly done by nurses and this is collaborated by a study in Tanzania, which showed that at least 85 % of medical waste in two hospitals was sorted at source (Manyele *et al.*, 2016). Aside this, was the challenge of inadequate funds for effective waste management and hiring of adequate sanitary workers to handle waste effectively.

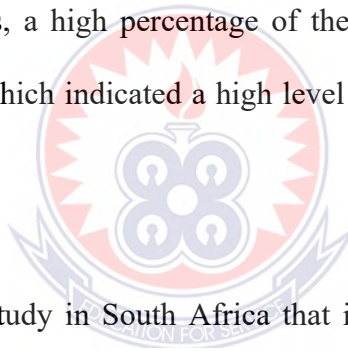
5.3.2 Opportunities that Exist for the Management of Medical Waste at Health Facilities

There are enormous opportunities for handling medical waste properly in the health facilities. Waste handlers and staff, including nurses and other health professionals are exposed to a minimal risk if strict adherence is made towards the proper use of protective equipment's. This is well consistent with a study by Babanyara *et al.* (2020), which showed that wearing protective equipment like the nose mask and safety boots will secure health staff from infections. The provision of personal protective equipment's (PPEs) and other relevant waste management materials available helps to reduce the high risk that where healthcare workers are exposed to (Nwanko *et al.*, 2018).

5.4 Knowledge, Attitude, Risk and Perceptions among Healthcare Workers on Medical Waste Management in the Sekyere Enclave

5.4.1 Knowledge on Medical Waste Management among Healthcare Workers

All the respondents involved in the study had knowledge on healthcare waste management and majority were aware of the safety precautions on healthcare waste management practices. This finding was fairly similar to a study by Odonkor and Tahiru (2020) which indicated that most respondents had knowledge on healthcare waste management. The knowledge and practice of healthcare personnel in respect of the disposal of medical waste is essential to perform effective medical waste management, (Pensiri *et al.*, 2020). According to the respondents, a high percentage of the respondents used color coding to identify and classify waste, which indicated a high level of understanding of medical waste management.



This was collaborated by a study in South Africa that indicated that about 95% of health staff had knowledge on the management of medical waste (Malebajtja *et al.*, 2016). The survey showed that, majority of the respondents had their knowledge on medical waste management through the ministry of health training, this was followed by educational institutions where respondents had their training. These results showed consistency with the study conducted by Sharma *et al.*, 2019 whose results showed that, healthcare staff source of knowledge was not in doubt as appreciable amount of healthcare staff had knowledge on medical waste management. Television and radios also provided the avenue for source of knowledge. The respondent's high level of knowledge might be because more than half of them had more than five years working experience and had completed a tertiary institution.

These findings are well consistent with (Gao *et al.*, 2020) who discovered that most respondents (87%) in a study conducted in Atbandhra medical college, India, had a high level of knowledge about handling medical waste since they had received education about medical waste management from special agency. The respondents agreed, training was also organized internally by the management of these health facilities to equip the health workers with the needed skills and experience in handling medical waste. Awareness of safe healthcare waste management practices among healthcare workers is very key in the reduction of hazards in our surroundings (Singh *et al.*, 2018).

5.4.2 Priority of Medical Waste Management among Healthcare Workers

The results of the study showed that, healthcare workers saw the need to prioritize the management of medical waste. Healthcare workers paid attention to basic safety precautions in medical waste segregation and agreed that it was necessary to wear gloves to prevent exposure to highly hazardous waste and to control the spread of infection. This result is well consistent with (Zamparas *et al.*, 2019), who indicated that healthcare staff knew the importance of wearing gloves and other protective equipment to save themselves from infections. The self-awareness of healthcare workers in handling medical waste was one of the most important skills that influence the quality of medical waste management. The survey is consistent with (Nalwaya *et al.*, 2017) who reported that all health workers in Saurashtra, India, concluded that safe disposal of medical waste was their duty and not an extra burden. However, it is worth noting that several studies done on hospital waste in developing countries such as India (Shalini, 2010; Sushma *et al.*, 2010), Bangladesh (Hassan

et al., 2008) showed inadequate, indifferent attitude among healthcare workers different from this current study.

5.5 Management Practices of Mortuary Generated Waste

5.5.1 Management Practices of Mortuary Waste

Mismanagement of mortuary waste is a significant risk factor for disease transmission. The occupational hazards to which mortuary staff and visitors are exposed can be exacerbated by poor training and unhygienic conditions (Keche *et al.*, 2021). The use of appropriate protective clothing and the observance of control of substances hazardous to health regulations can help to protect those who handle cadavers. Mortuary staff mostly worked with manual equipment. It was observed that individuals working in the mortuaries usually did not wear sufficient personal protective equipment (PPE) during autopsy. When interviewed using an in-depth approach, a few waste workers indicated that they had heard about policy regulation in the management of waste but had never seen a copy and many stated that they were aware of the hazards arising from infectious dead bodies and autopsy equipment. The study showed that, mortuary workers had training in the aspect of mortuary care, and learned what to do from management. The results of this study showed a substantial variation in the handling of medical waste generated at the health facilities that pose a risk of infection to mortuary staff. This was consistent with the work of (Gupta *et al.*, 2020). The observation showed that, the mortuary environment was also very dehumanizing for the staff that work there as they were faced with various stresses which included unpleasant smells, the sight of bodies which were burned or mutilated, and this was corroborated by the work of (Patwary *et al.*, 2010). The staff emphasized that, many of the

practices being carried out were not ideal, but were being done due to a lack of resources. Most of the respondents answered during the study that, this is the first time that someone had taken an interest on their working conditions. Figure 5.4 indicated a mortuary attendant preparing a dead body for burial without wearing proper protective equipment's.



Figure 5.4: Mampong Hospital Mortuary

5.5.2 Management of Solid Mortuary Waste

Workers in the mortuary unit of any health facility are involved in a lot of activities, which includes the collection of waste, transportation, and temporary storage thereof. In some cases, post mortem and embalming activities are conducted at the corpse storage facility. These activities lead to the generation of solid medical waste at the mortuaries (Molewa *et al.*, 2021). The study showed that, solid mortuary waste was not segregated at point of source. This study was consistent with Keche *et al.* (2021) whose results indicated that medical waste was not well segregated at point of generation in a study conducted in disposal of dead bodies. The respondents were not happy about the inadequate dust bins at the mortuaries and asserted it does not encourage the practice of strictly separating infectious waste from non-infectious waste. Clothes of the dead persons were burnt openly

at the premises of the Mampong hospital mortuary (Figure 5.5). The study showed that, the mortuary at Effiduase equally added the general waste to the infectious waste and openly burn the waste. The respondents admitted that, the practices carried out at the mortuaries were not ideal and do not conform to ministry of health policy guidelines in management of mortuary waste, but they agreed they were being done due to inadequate resources.



Figure 5.5: Premises of Mampong Hospital Mortuary

5.5.3 Management of Liquid and Organic Mortuary Waste

All dead bodies are potentially infectious and standard precautions should be applied to every case (Keche *et al.*, 2021). Liquid waste from human autopsy is generated, collected, and stored. Each autopsy generates 1 and 10 liters of liquid waste consisting of body fluids and rinse water used to clean and disinfect surfaces (Srinivasulu *et al.*, 2020). The survey showed that, liquid waste was drained through the sewer systems into a septic tank at Mampong hospital and Effiduase hospital. From an observation that was carried out, there wasn't any form of leakages that may pose public health threat. The study showed that, Agona S.D.A hospital mortuary was only designed to keep dead persons not more than 24 hours. This, according to the respondents, did not permit the normal handling of dead

persons within the facility. The study indicated that, autopsy, post mortem, embalment and bathing of dead persons were not done at the Agona S.D.A mortuary. The survey is consistent with (Gupta *et al.*, 2021) study, where water was not used under pressure for cleaning as it may re-aerosolize infectious material. Figure 5.6 shows the drainage systems at Mampong hospital where liquid waste is being disposed.



Figure 5.6: Mampong Hospital Sewer (Source: Field Data, 2020)



CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

- Healthcare waste management practices were influenced by the employee's knowledge and behaviour; this is seen in inclusion of training healthcare staff on medical waste management.
- Huge amount of healthcare waste generated in the medical facilities in the Sekyere enclave were mixed up with the municipal waste which does not correspond to international best standard.
- Workers who were involved in healthcare waste management practices lacked important knowledge and awareness of safe practices.
- Challenges and opportunities of the management of health care waste were identified which extensively aided in reduced compensation and reduced loss of lives and infections.
- Mortuaries lacked dumping site and incinerators for mortuary waste management.
- Waste generated at the mortuaries were burnt openly which could lead to threat to public health and the environment.

6.2 Recommendations

Management of Health Facilities

- Management of Health Facilities should organize training courses periodically for health workers to conscientize them on general medical waste management practices.

- All medical storage areas must be large enough so they do not overflow and separate spaces must be provided for different types of waste.
- Colour coding of waste bins must be deployed in all health facilities.
- Financing and budgeting for medical waste management should be very essential and must include cost of waste management equipment and treatment infrastructure.

Ministry of Health

- The ministry of health should be the lead governing entity and regulator in establishing, implementing, and enforcing legislation in the areas of duty of care, hazardous waste management, and permitting and licensing.
- Adequate number of orderlies should be employed by the ministry of health for effective waste management in health facilities.
- The ministry of Health should employ permanent Environmental health officers so as to ensure that compliance with regulations in handling waste at the health facilities are strictly adhered.

Municipals and District Assemblies

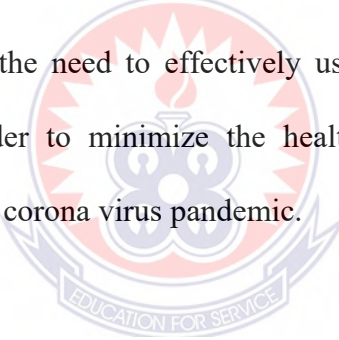
- There is a need for an integrated approach to healthcare waste management in Ghana that will entail the coordinated efforts of the municipal and district assemblies as well as the Ministry of Health and private companies contracted to collect, transport, and dispose of waste.
- It is recommended that; the assemblies ensure that methods used to transport medical waste should be appropriate to the individual circumstances of health facilities and

compliant with national transport regulations that is stipulated in the ministry of health medical waste policy regulation. Hazardous and non -hazardous waste must not be moved together.

- There should be the need to have effective monitoring systems of assessing waste disposal processes and systems to ensure that the effects of improper practices are not underestimated.

Health Staff

- It is recommended that; all health workers adhere to the strict practices of segregating waste generated from their outfit in the various units in the facilities they work.
- Health workers must see the need to effectively use personal protective equipment's provided for them in order to minimize the health risk that they are exposed to, especially in this era of the corona virus pandemic.



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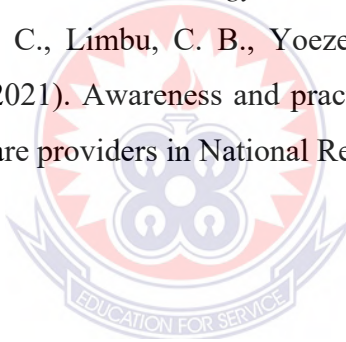
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APPENDICES**APPENDIX A****Survey Questionnaire on Management Practices of Medical Waste Among Health Care Workers. A Case of Sekyere Enclave of Ashanti Region of Ghana.**

I Adams Yaw Ibrahim a student of University of Education, Winneba, undertaking a study on management practices of medical waste among health care workers; A case of Sekyere enclave of Ashanti Region of Ghana. I therefore seek your support by participating in a survey as a respondent and any information you provide will be treated with anonymity and your answers will remain confidential.

Informed **CONSENT**: Agreed [] **Facility**:.....

Biodata/profile			
No	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
1.	Date of interview :		
2.	Age of respondent	Below 20years.....1 20 – 29 years.....2 30 – 39 years.....3 40-49 years.....4 50 and above.....5	
3.	Sex of respondent:	Male.....1 Female.....2	
4.	Highest educational level:	Primary.....1 JHS/Middle form.....2 SHS/O’level.....3 Tertiary.....4 Other (specify)5	

5.	Marital status	Married.....1 Single.....2 Divorced3 Separated4	
6.	How long have you being working in the hospital?	Under 5 years.....1 6-10years.....2 11-15years.....3 16-20years.....4 Other (specify).....5	
7.	What is your position?1	
8.	Which department in the hospital do you work?	Mortuary.....1 OPD.....2 Ward.....3 Maternity.....4 Other(specify).....5	
Knowledge, attitude, and perception of healthcare workers			
9.	Do you have education on healthcare waste management?	Yes.....1 No.....2	→ Q10
10.	If yes, where did you acquire it?	Educational institution.....1 Television.....2 Radio3 Ministry of health Training.....4 Other (specify).....5	
11.	Are you aware of the consequences of poor healthcare waste management?	Yes.....1 No.....2	
12.	If Yes, what are some of the consequences of poor healthcare waste management?	Environmental pollution.....1 Outbreak of diseases.....2 Others(specify)3	
13.	What are some of the environmental pollution caused	Litter on the compound.....1 Choked of gutters.....2	

	by poor health care waste management?	Others.....4	
14	What are some of the diseases of poor healthcare waste management?	Malaria.....1 Cholera.....2 Diarrhoea.....3 Others.....4	
15	What are the causes of poor healthcare waste management?	Lack of containers.....1 Lack of education.....2 Amount charged on waste disposal.....3 Distance to site of waste disposal.....4 Others(specify)5	
16	Who is responsible for proper health care waste management?	Health Admins.....1 Doctors.....2 Hospital Orderlies.....3 Nurses.....4 Others(specify)5	
17	Whom do you blame for improper healthcare? waste management?	Health Admins.....1 Doctors.....2 Hospital Orderlies.....3 Nurses.....4 Others(specify)5	
18	Is health care waste a priority to healthcare workers in the hospital?	Yes.....1 No.....2	→ Q19
19	If yes, how is it seen?	Training on waste management.....1 Inclusion in budget2 Provision of waste materials....3 Maintenance of waste disposal	

		site.....4 Others(specify)5	
Waste generation, segregation and storage			
20	What type of waste is generated in the hospital?	Hazardous waste.....1 Non-Hazardous waste.....2 Both.....3	→ Q21 → Q22
21	Which of the following hazardous waste is generated most in the hospital?	Tissue and body parts.....1 Expired drugs.....2 Disinfectants.....3 Sharps and blades.....4 Radioactive waste.....5 Heavy metals waste6 Other (specify).....7	
22	Which of the following non-hazardous waste is generated most in the hospital?	Paper, trash.....1 Boxes.....2 Bottles.....3 Plastic containers.....4 Food waste.....5 Other (specify).....6	
23	Which of the days do you generate waste most?	Weekdays.....1 Weekends.....2	
24	Which of the department generate waste most?	Ward.....1 Maternity waste.....2 Mortuary.....3 X-ray section.....4 Pharmaceutical department.....5 OPD.....6 Laboratory.....7 Other (specify).....8	

25	In what do you store waste before disposal?	Plastic waste bin with lid.....1 Plastic waste bin without lid...2 Metal waste bin with lid.....3 Metal waste bin without lid...4 Empty boxes.....5 Other (specify).....6	
26	Is waste separated into different containers?	Yes.....1 No2	→ Q28
27	If no, why?	
28	Are bins used for waste storage colour coded?	Yes.....1 No..... 2	→ Q30
29	If no, why?	
Waste transportation and disposal			
30	What method do you use to transport waste in your hospital?	Transportation within hospital.1 Transportation outside hospital2 Both.....3 Other (specify).....4	
31	Do you have a waste treatment system in your facility?	Yes.....1 No..... 2	→ Q33
32	If yes, which treatment system is being used by your hospital?	
33	Is there a system put in place for final disposal of waste?	Yes.....1 No2	

34	If yes, which of the following options is used by your hospital for final disposal of solid waste?	Container.....1 Landfill.....2 Both.....3 Other (specify).....4	
Health and Safety issues associated with hospital waste			
35	Are you aware of the available regulations regarding hospital waste management?	Yes.....1 No2	→ Q37
36	If yes, how did you get to know?	Hospital administrators.....1 School.....2 Television.....3 Online.....4 Other (specify).....5	
37	Are you aware of risk associated with hazardous solid hospital waste?	Yes..... 1 No2	→ Q39
38	If yes what are the risk associated with hazardous solid hospital waste?	Contraction of diseases.....1 Cuts.....2 Burns.....3 Other (specify).....4	
39	What are some of the safety measures put in place in your hospital with respect to hospital waste management? (tick as applicable)	Proper waste management as part of orientation on first employment.....1 Regular monitoring on safety and health standards to ensure if workers are complied with.....2 Using protective clothing Prompt reporting of accidents/injuries.....3	

		Re-training on safety and health practices.....4 None.....5 Other (specify).....6	
40	Indicate how satisfied you are with the current health and safety measures put in place in hospital waste management?	Very satisfied.....1 Satisfied.....2 Dissatisfied.....3 Very Dissatisfied.....4	
41	The person ultimately responsible for your safety and health in the performance of your duties is?	Administrator.....1 Medi supt.....2 Yourself.....3 Other (specify).....3	
42	Is there safety inspection in the performance of managing waste?	Yes.....1 No.....2	→ Q44
43	If yes, what kind of inspection?	Waste collection safety.....1 Waste separation safety.....2 Waste transport safety.....3 Other (specify).....4	
44	Does your hospital provide health and safety training for workers before managing waste?	Yes.....1 No.....2	→ Q46
45	If yes, on what type of training is provided?	Proper usage of safety materials.....1 Safety measures to observed...2 Proper waste management.....3 Other (specify).....4	
Waste manual and its opportunities			
46	Is there waste manual (waste management policies and plans) available?	Yes.....1 No.....2	→ Q48

47.	If yes, provide a copy for verification	
48.	Do you apply or follow the waste management manual?	Yes.....1 No.....2	→ Q50
49.	If no, why	
50.	Do you think effective use of health care waste policies have any impact on job performance in managing of waste?	Yes.....1 No.....2 Not sure.....3	→ Q40
51.	If yes, what benefits will the health care workers derive from effective healthcare waste policy adherence?	Reduces accident.....1 Reduces cost of compensation to injured employees.....2 Lost or death of staff.....3 Labour turnover is reduced.....4 Corporate image of the hospital is enhance.....5 Other (specify).....6	

APPENDIX B

In-depth Interview Field Guide: MALE/ FEMALE

Study Title

**Management Practices of Medical Wastes among Health Care Facilities: A Case of
Sekyere Enclave of Ashanti Region of Ghana**

Researcher:

Adams Yaw Ibrahim

1. General Information

Date: **Start Time:**..... **End Time:**.....



II. OPENING REMARKS

Thank you for agreeing to meet with me today, my name is Adams Yaw Ibrahim. I am from the University of Education Winneba. This interview will last between an hour and an hour and half. Before we begin, I'd like to first ask if it is ok with you if I record this discussion on a digital recorder? The recording will only be accessible to members of our research. Are you ok with having this interview recorder?

During this interview, I will ask you questions about the management practices of medical waste generated in this your health facility. You do not have to answer any question you do

not feel comfortable answering and you are free to stop the interview at any point if you choose to do so.

Do you have any questions before we begin?

III. Participant Information

I'd like to first ask you a few questions about yourself.

How old are you?.....

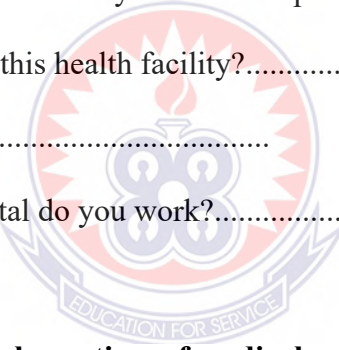
Are you married?.....

What is your highest level of education you have completed?.....

How long have you worked in this health facility?.....

What is your position?.....

Which department in the hospital do you work?.....



VI. Structures and operational practices of medical waste

I'd like to ask you more in-depth questions about how medical waste is being managed in this hospital. Kindly feel free to share with me as much information as you'd like and remember that there are no right or wrong answers to these questions.

1. What are the existing structures and practices for the management of medical waste in the hospital?

PROBE: Does your hospital have the necessary infrastructure in place to manage waste?

PROBE: Does your hospital have a dumping site?

2. What processes does waste management goes through in the hospital?

PROBE: Does your hospital have incinerator?

PROBE: What is the type of waste generated at this hospital?

PROBE: Do you transport and dispose of your waste outside the hospital?

3. How do you adhere to ministry of health waste management policy regulation?

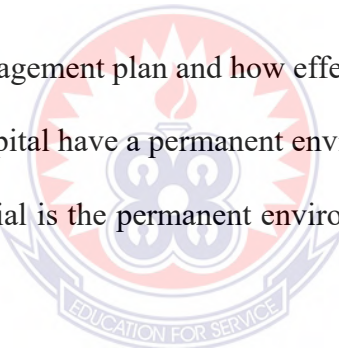
PROBE: Are you aware of the waste regulation manual?

PROBE: Do you have a copy of the waste management policy manual? Yes/No

4. Is there internal waste management plan and how effective is that?

PROBE: Does the hospital have a permanent environmental health officer?

PROBE: How beneficial is the permanent environmental health officer to the waste management in this hospital?



V. Knowledge, perception and attitude of healthcare workers

5. How often does the management provide training for staff of the hospital on waste management?

6. Are the orderlies enough to manage the hospital waste?

7. How effective are the works of the orderlies?

8. How effective is the management system adopted by the hospital?

9. What constitute waste in this hospital?

PROBE: Does your hospital generate pathological waste?

10. How is pathological waste treated and disposed?

11. Do you monitor disposal of pathological waste?

12 If Yes, how is monitoring done?

13. What facility exist for the management of pathological waste?

PROBE: Does your hospital have pathological waste pit?

VI. Challenges, opportunities, health and safety issues associated with hospital waste

14. What PPEs are purchased and used by the waste workers in the hospital?

15. How effective is the usage of PPE by waste management workers and including the mortuary workers?

16. What are the reported cases of accidents/injuries by waste management workers?

17. What are the procedures for the collection, storage and handling of solid medical waste from the units?

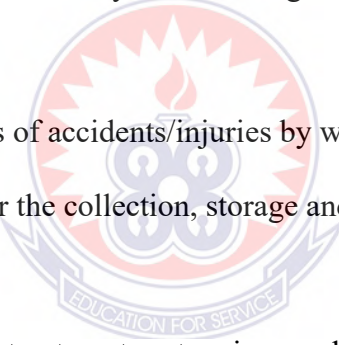
PROBE: Do you have a waste treatment system in your hospital?

PROBE: Is there a system put in place for final disposal of waste?

PROBE: Do you segregate your waste in your hospital?

18. In your opinion, how can management of solid hospital waste be improved in the Hospital?

19. Does your hospital have enough fund to manage the hospital waste?



APPENDIX C

Table 4.8: Environmental pollution associated with poor healthcare waste management

Environmental pollution Facility	Littering n(%)	Choked gutters n(%)	Total n(%)	P-value
Mampong Hospital	52(12.30)	43(10.20)	95(22)	
Ejura Hospital	69(6.30)	54(12.90)	123(19.2)	
Effiduase Hospital	11(2.50)	9(2.10)	20(4.60)	
Agona Hospital	23(5.40)	18(4.20)	41(9.60)	
Agona S.D.A Hospital	21(5.00)	17(4.00)	38(9.00)	
Kumawu Polyclinic	14(3.30)	14(3.30)	28(6.60)	
Divine Health Center	11(2.50)	8(1.90)	19(4.40)	
Drobonso Health Center	15(3.50)	10(2.40)	25(5.90)	
Nsuta Health Center	17(4.00)	16(3.80)	33(7.80)	
Total	233(55.00)	189(45.00)	422(100)	0.582327

Table 4.11: Benefits of adherence to medical waste policy regulation

	Reduced accident	Reduces compensation	Reduction of death	Labor turnover	Total	P-value
FACILITY	n(%)	n(%)	n(%)	n(%)	n(%)	
Mampong Hospital	54(6.40)	58(6.70)	56(6.50)	47(5.60)	215(25.20)	
Ejura Hospital	59(6.90)	62(7.10)	58(6.70)	52(6.20)	231(26.90)	
Effiduase Hospital	11(1.30)	11(1.30)	9(1.00)	8(1.80)	39(5.40)	
Agona District Hospital	15(1.80)	17(2.00)	15(1.70)	14(1.60)	61(7.10)	
Agona SDA Hospital	18(2.10)	17(2.00)	14(1.60)	11(1.30)	60(7.00)	
Kumawu Polyclinic	17(2.00)	19(2.20)	18(2.10)	15(1.70)	69(8.00)	
Divine Health Center	12(1.40)	14(1.60)	13(1.50)	10(1.20)	49(5.70)	
Drobonso Health Center	14(1.60)	15(1.70)	12(1.40)	11(1.30)	52(6.00)	
Nsuta Health Center	21(2.50)	22(2.50)	21(2.40)	17(2.00)	81(9.40)	
Total	221(26.00)	235(27.00)	216(25.00)	185(22.00)	857(100)	0.931786

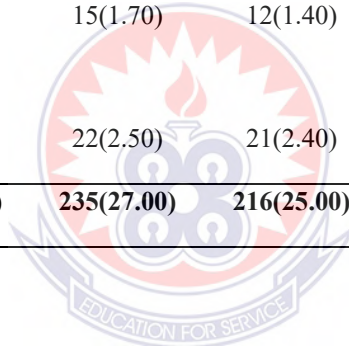


Table 4.12 Healthcare waste storage and segregation (take to appendix and allow the graph)

HCW storage and Segregation	plastic bin with lid	metal waste bin with lid	Total
FACILITY	n(%)	n(%)	n(%)
Mampong Municipal Hospital	53(18.00)	12(4.00)	65(2.20)
Ejura Municipal Hospital	74(25.00)	10(3.00)	84(28.00)
Effiduase District Hospital	12(4.00)	1(0.00)	13(4.00)
Agona District Hospital	33(11.00)	(0.00)	33(11.00)
Agona SDA Hospital	29(10.00)	(0.00)	29(10.00)
Kumawu polyclinic	18(6.00)	2(1.00)	20(7.00)
Divine Grace Health Center	12(4.00)	3(1.00)	15(5.00)
Drobonso Health Center	17(6.00)	2(1.00)	19(6.00)
Nsuta Health Center	20(7.00)	2(1.00)	22(7)
Grand Total	268(89.00)	32(11.00)	300(100)

