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Medical Waste Management: Study of Household Practices and Potential Harm in the Developing Countries Like South Africa.

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ABSTRACT

Medical care is important for our life, health and well-being however the waste generated from medical activities can be hazardous, toxic and even poisonous because of the high potential for diseases transmission. With the increasing generation of medical waste worldwide, managing medical waste has become crucial, given its potential environmental and public health risks. Environmental regulators and waste producers have made extensive efforts in recent years to improve waste management at healthcare facilities however little to no effort invested in waste generated in the home-based care giving space. Significant amount of health care risk waste is generated in the process of home health. This waste poses serious threats to the health and the environment because it is infectious and hazardous in nature. This study presents an overview of the status of medical waste management in Pretoria, South Africa. Accordingly, we examined various medical waste treatment policies and methods that are being implemented in other countries, in addition to the main strategy of waste management. To determine preferable directions for the improvement of the medical waste generated during home-based care giving, the research adopted snowballing research approach of collecting data. Waste generated by home-based care givers was assessed and management practices investigated. Results revealed that there is health care waste generated in home health. The generated health care risk waste is mixed with the general household solid waste and managed in the same manner as domestic waste. The researcher investigated and compared the status of domestic and foreign waste management and proposed directions for improvement, focusing on several issues related to the current medical waste management system in South Africa.

Management of health care risk waste in a safe and efficient manner is important and it is the responsibility of all generators, including home-based care givers. This is for the protection of the environment, preservation of human health, and to comply with all waste management laws such as the National Environmental Management: Waste Act. The study recommends a new policy framework that will lead to safe management practices of generated health care risk waste to be adopted by home-based caregivers.

Keywords: *Environment; Health; Home-based care; Medical waste; Hazardous; Waste*

ABBREVIATIONS AND ACRONYMS

AIDS – Acquired Immuno-disease Syndrome

CANSIs - Community acquired needle stick injuries

CoJ – City of Johannesburg

CoT – City of Tshwane

DEAT – Department of Environmental Affairs and Tourism

EEA - European Environmental Agency

EPA – Environmental Protection Agency

HCG – Home-based care giver

HCRW – Health care risk waste

HCP – Health care professional

HCW – Health care waste

HIV – Human immunodeficiency virus

IWM – Integrated waste management

LCA – Life Cycle Assessment

NEMA – National Environmental Management Act

NEMWA – National Environmental Management Waste Act

NHS – National Health Service

PTP – Participant

RCRA - Resource Conservation and Recovery Act

RSA – Republic of South Africa

RHCs – Rural health centres

SA – South Africa

SADC – Southern African Democratic Countries

SANS – South African National Standards

SMW – Solid medical waste

TB – Tuberculosis

UK – United Kingdom

UNDP - United Nations Development Program

USA – United States of America

WHO – World Health Organisation

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CHAPTER 1

1.1 Introduction

The growth of the medical sector around the world combined with an increase in the use of disposable medical products has contributed to the large amount of medical waste generated. Shiferaw *et al*., (2021) states that poor medical waste management causes environmental pollution, unpleasant smell, microbial growth and multiplication of insects, rodents and worms, and may lead to transmission of diseases like typhoid, cholera, and hepatitis through injuries from sharps contaminated with blood. The definition of health care risk waste to be managed and disposed varies widely for different countries and regions resulting in several different terms used to define and describe health care risk waste. The terms are: clinical waste; health care waste; infectious waste; medical waste; hospital waste; health care risk waste; biomedical waste and bio-hazard waste (WHO). The term used in South Africa is Health care risk waste (NEM: WA, 2008). The World Health Organization (WHO) describe medical waste, also known as health care waste (HCW) as any by-products that is generated in the diagnosis; treatment and/or immunization of people or animals, in research pertaining to, or testing of biological, including but not limited to blood soiled instruments and bandages, cultures dishes, surgical gloves, needles, lancets; swabs, instruments and removed body parts or organs (Chartier, 2014). The terms used generally refer to materials generated as a result of patient diagnosis, treatment, or immunization of human beings or animals, and in research pertaining thereto, or testing of biologicals, including but not limited to soiled or blood-soaked bandages, culture dishes, and other glassware. Health care risk waste is defined as the wastes generated by health-care activities that can include a wide range of materials, such as used needles and syringes, soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices and radioactive materials (Chartier, 2014). Discarded surgical gloves and instruments, lancets, cultures, stocks, and swabs used to inoculate cultures and removed body organs.

HCW can be subdivided into various categories (Table 1-1). Segregation of these different waste categories is critically important to enable proper disposal. According to Yawson (2014), the non-hazardous waste also known as general waste is comparable to domestic waste and it makes the bulk of the medical waste, makes up to 70 - 90% of this waste. This waste is generated from the administrative works, packaging and maintenance works while the hazardous waste constitutes between 10 – 30% of the medical waste. The hazardous waste comprises sharps, infectious, pathological, chemical, cytotoxic and radioactive waste as highlighted in Table 1-1 below:

Table 14-1: WHO categories of health care waste

1.Hazardous waste	***Description and examples***
Infectious waste	Waste suspected to contain pathogens, e.g., laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that has been in contact with infected patients; excreta or body fluids like dressings, bandages, swabs, glove, masks, gowns, drapes.
Sharps waste	This is waste that consists of used or unused sharps such as needles, auto disable syringes, syringes with attached needles, infusion sets, scalpels, pipette, knives, blades and broken glass.
Pathological waste	Human tissues or fluids, e.g., body parts; blood and other body fluids; fetuses; sharps waste, e.g., needles; infusion sets; scalpels; knives; blades; broken glass.
Pharmaceutical waste	Waste containing pharmaceuticals, e.g., pharmaceuticals that are expired or no longer

	needed; items contaminated by or containing pharmaceuticals (bottles, boxes).
Genotoxic waste	Waste containing substances with genotoxic properties, e.g., waste containing cytostatic drugs (often used in cancer therapy); genotoxic chemicals.
Chemical waste	Waste containing chemical substances, e.g., laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents; wastes with high content of batteries; broken thermometers; blood- pressure gauges; heavy metals; gas cylinders; gas cartridges; aerosol cans.
Radioactive waste	Waste containing radioactive substances, e.g., unused liquids from radiotherapy or laboratory research; contaminated glassware, packages or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources.
2.Non-hazardous waste	All waste that does not pose chemical, biological, physiological or physical hazard, for example, paper, cardboards, plastics, discarded wood, metal, glass, textiles and plastics.

According to the South African National Bureau of Standard (SANS, 2011), medical waste management is defined as "all activities, administrative and operational, involved in the handling, treatment, storage, recovery, recycling, transportation until the disposal of waste".

The waste management framework in South Africa is founded on a range of legislation, which is intended to manage and prevent environmental pollution, the most relevant among them being the laws on the disposal and treatment of hazardous substances (Hazardous Substances Act 1973 (RSA Act No 15, 1973). Other relevant legislations include the Environment Conservation Act 1989 (RSA Act No. 73, 1989); and the National Environmental Management Act 1998 (RSA Act 107, 1998). Furthermore, the Local Government: Municipal Systems Act 2000 (RSA Act 32, 2000) requires that waste management services be provided to all local communities in a financially and environmentally responsible manner, in order to promote basic service accessibility as well as sustainable waste management services.

1.2 Background of the research problem

South Africa is currently experiencing what is termed by the National Department of Health a quadruple burden of diseases that are chronic in nature. Quadruple burden of disease means that South Africa is experiencing a mixture of five colliding epidemics. These epidemics are human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) and tuberculosis, maternal and child mortality, non-communicable diseases, violence leading to injuries and trauma and COVID-19 (Department of Health, 2023). The Minister of Health in SA stated that the burden of diseases, especially HIV/AIDS, places stress on the already strained health care facilities. There are numerous people that require medical attention as a result of this quadruple burden, and their number is increasing on a daily basis. Both the public and the private health care facilities are strained as a result. Landman *et. al.*, (2001) states that, the public health care facilities are more strained than the private health care facilities in terms of financial, human and equipment resources. This is because the majority of South Africans rely solely on public health care facilities because they are living below the poverty line and are therefore unable to afford private health care (Landman *et. al*., 2001).

To ease the burden on health care facilities, the South African government reintroduced home-based care services (Mieh., *et al*, 2013). Home-based care is an old concept that dates back to 1813; however, it is now gaining more prominence and becoming widespread. Home-based care is a primary health programme and is recognised as the most cost-effective strategy for delivering essential health care programmes to communities (Willcox *et. al*., 2015). This concept has expanded over decades, mainly as a way of shortening periods of hospital care and reducing health costs. This is any form of care given to sick people in their own homes and also referred to as home health care. Services that are offered are nursing care, physical care, patient support, domestic chores, and psychological care. Nursing care includes dressing wounds, administering medication, and supervised treatment support (directly observed treatment support). Physical care includes assisting patients to use toilets, feeding and bathing patients, changing patients, and helping patients exercise. Domestic chores include collecting water for patients, and cleaning and laundry for patients. The psychological care includes health education, counselling, rehabilitation, and praying. Support includes referring patients to health care facilities, identifying people who do not have any source of income, and bereavement counselling. It also provides promotive and preventative services. According to Mataure (2018), the services of home-based care are directed at all people who may be in need of care, such as frail older people, people with moderate to severe functional disabilities, people recovering from illnesses who are in need of assistance, terminally ill persons, persons living with HIV/AIDS or any other chronic diseases and any other disadvantaged group.

People that work in the home-based care programme are referred to as home-based caregivers. They are generally physically fit middle-aged women from the community. According to Akintola (2014:26) the home-based caregivers do not have medical training but undergo home-based care training. The training introduces them to various aspects of home-based care such as diseases and disability, management of patients' condition and treatment, assisting patients with mobility and preventing complications, and patient referral (Akintola (2014:26). Ramuhaheli (2010) adds that the training offered is focused on the basic nursing care, life skills, counselling, case-finding, and record-keeping. It is designed to capacitate and equip caregivers to provide necessary help for the community they serve. The services provided by home-based caregivers yield numerous benefits. However, home-based caregivers face the challenge caused by the generation of health care risk waste (Hangulu *et al*.,2012). There are large volumes of

health care risk waste arising from care given by home-based caregivers and currently there are no arrangements made to correctly manage the generated waste (Hangulu *et al*.,2012).

(Hangulu *et al*.,2012) adds further and sat that the management of health care risk generated by home-based caregivers is a mounting problem, especially in developing countries such as South Africa that have inadequate resources and lack of cost-effective waste disposal processes. Medical waste can be classified into two types or classes: the non-hazardous waste and the hazardous waste. The past two decades have witnessed transition from in-patient hospital admission and care to community and home-based care due to the upsurge in chronic health conditions. This was caused by the heightened HIV and AIDS epidemic that has seen its prevalence particularly in Sub-Sahara Africa. This includes South Africa, which has one of the highest HIV prevalence in the world. The current global situation update reported a reduction in HIV incidence by more than 25% in southern Africa over the last decade (UNAIDS 2012:6). The Ministry of Health responded to the increase in AIDS related chronic illness by allowing lay people or less qualified community health workers to provide care, as qualified staff emigrated for better remuneration. The lay workers have received little recognition and support from the health care system for their efforts. This has caused them to perform poorly and display limited enthusiasm (Osika et al 2010:10, 15). Consequently, non-profit groups have led communities into community and home-based care activities. The national health system has provided limited input for home-based care programmes, due to inadequate resources, leaving private voluntary organisations implementing relatively uncoordinated activities. If patient's input and goals for good health and care are key to successful health outcomes; it is important that this study examines the related dynamics within the home-based care interventions. It is uncertain whether decisions made lead to measurable and expected outcomes of quality, effectiveness and efficiency. The reactive modern medical care model is progressively being replaced by community and home-based care initiatives, designed in full consultation with service users.

Medical waste disposal has been assessed in previous years however less focus was given to the medical waste generated in the households. Household hazardous waste includes household hazardous packaged goods and expired medication is waste that has substantial or potential threats to public health or the environment.

1.2.1 Problem statement and rationale of this study

The number of chronically ill clients being cared for at home is now increasing and this was experienced recently with the recent pandemic, COVID-19. The World Health Report (WHO 2000a:117-122) describes ministries of health as "stewards of [the] health system" in a country, and the report emphasises that, appropriate stewardship "makes possible the attainment of each health system goal; improving health, responding to legitimate expectations of the population, and fairness of contribution. Stewardship must filter through all levels of the health system to maximise the attainment of set goals." The report goes further to assert that in general, most ministries of health are not cognisant of this fact. The researcher has identified this observation as one key area of concern in home-based care to be investigated.

1.3 Research aims and objectives

This study is motivated and aims to critically review the household hazardous waste management in South Africa in order to establish the current practices, identify existing challenges and focusing on the risk associated with poor handling of medical waste. The aim of my study is to understand how medical waste generated in the households are managed.

The purpose of the study is two-fold:

- To understand if home-based care givers are trained on medical waste management; and
- To understand if the training given is effective in the management of the medical waste generated in their line of duty of home base care giving. It also aims to identify the areas of improvement and where more attention is required.

1.4 Overview of research methodology

To reach the aim and objectives set above this study will consult the following literature sources: library books, journal articles, international best practice guidelines, and relevant Masters and PhD dissertations. This study will follow a deductive approach, which is the "theory testing process" that utilizes existing data (Hyde, 2000:83). I will be doing semi-structured questionnaire, consisting of closed and open-ended questions. I will use purposive and snowball sampling and have interviews with home-based care managers and givers. These

interviews will either be mailed for participants to self-administer, and/or face-to face interviews telephonically.

1.5 Structure and outline of this thesis

Chapter 1: Introduction and problem statement

This chapter will cover the introduction and background of the topic and the motivation on why this topic is of interest. It will further include the research problem being addressed, the research aims and objectives. A detailed discussion of the methodology will also be provided in this chapter.

Chapter 2: Literature Review

In this chapter will review existing literature on medical waste management and the effectiveness of medical waste management internationally and in South Africa. Various debates related to effectiveness of medical waste management will be explored.

Chapter 3: Medical Waste Management International best practise

This chapter will include and overview and discussion of medical waste management international best practice. This chapter will explore the legislative, procedural and institutional frameworks, including problems related to effective medical waste management and opportunities of improving medical waste management.

Chapter 4: Research findings and data analysis

This chapter will include the research findings and data analysis from the interviews with waste generators & waste companies and comparing it with the findings from the literature.

Chapter 5: Conclusion and Recommendations

This chapter will conclude the study by summarizing the research findings and provide recommendations for future research and practice.

1.6 Significance of this study

There is presently limited comprehensive and robust analysis and evaluation of the home-based care giving programme that may determine its successes and weaknesses in attaining the goals and needs of clients as end-users. This study aims to bridge this gap. While there are many non-governmental organisations supporting home-based care activities throughout South Africa, there have been no rigorous and independent evaluations of this nature. This study will pioneer this area of exploration, and provide valuable information for implementing agencies with mandates to identify and meet the health requirements of chronically ill people at the community level through health interventions. Through various studies, the needs of chronically ill people have been found to vary depending on the cultural context and geographical area in which people reside. A comparative study of chronically ill patients in Zimbabwe; Kenya and Scotland revealed vast differences in the needs and experiences of clients in these three countries (Murray, Grant, Grant & Kendall 2003:2; Thorne et al 2003:1349-1350). This suggests that a similar situation is also possible within a single country with diverse cultural and geographical settings, such as there are in South Africa. The research will inform and influence policy formulation for public health interventions in community and home-based care. Findings will expand knowledge and strengthen the capacity of policy makers, donors and implementers to design evidence-informed, community-centred, integrated and sustainable programmes that respond to the health needs of clients.

CHAPTER 2

2.1 Introduction

Chapter one introduced and discussed the different types of medical waste and the concept of waste management. The chapter further highlighted the origins and development of waste management acts, policies and regulations. Chapter 1 further introduced the problem statement and outlined the structure of this research study. In order to attain the aim of this study, this chapter (Chapter 2) reviews the existing literature on medical waste management best practice and effectiveness. This chapter first provides a detailed discussion on the value of waste management and then looks at medical waste generated in the household's management best practice in line with the medical waste policies and tasks of medical waste management, then discuss the international best practice and then, compare the status of best practice of medical waste generated in the households internationally to the South African practice. This chapter lastly discusses the possible impacts of incorrect waste management disposal using available literature relating to the medical waste management in South Africa.

2.2 History of home-based care

Home healthcare is not a new concept. Tshabalala (cited in Peu, 2008:3) pointed out that it can be traced back to the 1600s, when religious and charitable groups devoted themselves to caring for the sick. According to Clemen-Stone, McGuire and Eigsti (2002), the St Francis de Sales Association arranged for wealthy women who were willing to assist to visit and care for the sick in their homes. Allender and Spradley (2005:27) observed that this kind of nursing of the sick experienced a setback during the Industrial Revolution, which brought a radical shift in the balance of rural and urban populations.

The World Health Organisation (WHO, 1985:87) explained that home-based care is the provision of health services by formal and informal caregivers in the home in order to promote, restore and maintain a person's maximum level of comfort, function and health including care towards a dignified death.

Haug (1985) stated that the overall goal of home/community-based care is to provide high quality, appropriate and cost-effective care to individuals that will enable them to maintain their

independence and have the best quality of life. Van Rensburg (2004) defined home-based care (HBC) as the care provided to an individual in their own home by their family and assisted by experienced welfare officers and communities to meet not only the physical needs, but also the spiritual, material, and psychosocial needs of the patient and their family members.

Akintola (2004) refers to home-based care as the moderating of pain or sorrow by making it easier to bear. This is given to patients as early as possible in the course of any chronic, ultimately fatal illness. It furthermore includes symptomatic and pain control, nutritional support and meeting the patient ‘s holistic needs through counselling.

The World Health Report (2008) further defined the full scope of home-based care as a method which enhances the value of patients and their families confronting severe illness through the prevention and relief of distress, by means of early detection and impeccable assessment and treatment of pain and other problems, whether physical or spiritual. The World Health Report (2000) advised that home-based care should commence at the time of analysis of a terminal sickness and can be interrelated with treatments for nursing opportunistic illnesses. Van Dyk (2005) asserted that the intention of terminal nursing is to develop the value of day-to-day living, and at the end of life, by alleviating symptoms (particularly pain) and allowing patients to die in peace, with self-respect and in keeping with their wishes.

2.2.1 Objectives of home-based care

The ultimate goal of HBC is to provide outstanding and suitable care to assist sick patients and their relatives to maintain their independence and achieve the best quality of life in the comfort and familiarity of their own homes (Uys, 2003). Furthermore, caregivers are trained to counsel patients and their families, help to monitor their medication needs, teach the primary caregivers about symptomatic treatment, and monitor the needs of the children in these homes (Peu, 2008).

One of the most lasting benefits of home-based care is the way in which it reduces the stigma surrounding HIV/AIDS, as the community sees the way these caregivers touch and care for those who are infected with HIV. The care given towards the patients enables the community to address its misconceptions and prejudices about HIV/AIDS, making the community less afraid and less inclined to reject those infected with the virus (WHO 2000).

2.2.2 Advantages of home-based care

Van Dyk (2005) and Uys (2003) maintained that patients who are ill or dying would rather remain at home so that they can spend their last days in a familiar environment. This is also the case when they are aware that hospitals do not offer any cure. Ill patients are supported by being in their private homes and neighborhoods, with relatives and loved ones near them. Marston (2003:79) pointed out that, as a result of HBC, the pressure on hospitals is systematically reduced and health professionals can use their time more effectively to care for other critically ill patients in hospitals. Uys (2003) agreed and stated that home-based care programs reduce the enormous pressure on provincial and national health budgets, which are already strained to breaking point. Beechey (2004:78) showed that these networks support them medically, as well as provide socio-emotional support, whilst simultaneously encouraging the patients and their families to remain healthy. Fawcett (1989:12) added that HBC facilities develop links between the chronic patients and their families and other people living with chronic illnesses like HIV/AIDS who understand what it means to be HIV-positive.

Care and support is holistic and inclusive because the patients are cared for physically, emotionally, spiritually and socially by trained caregivers with the aim of healing their bodies and souls. Beechey (2004) argued that a holistic approach is particularly important in dealing with a condition that may last for many years and which has wide-ranging social ramifications. Perhaps the most important difference between hospitalization and home-based care is the support groups that arise out of this care, both for the patients and the caregivers. Marston (2003:115) highlighted a critical point in that HBC is sympathetic to the culture and the value systems of the local community, an understanding that is often absent in clinical hospital settings. He suggested that HBC workers are in an ideal position to identify the needs of children who are affected by the illness of their siblings (Marston, 2003). The HBC givers can then also assess issues pertaining to children such as, for example schooling, child psychological support, and the question of who will look after the child after the death of the parent or guardian.

2.3 Importance of Medical waste management

It is ironic that the healthcare system, which is established and trusted to provide treatment and safeguard the health of the people against illnesses, becomes the possible source of infections and means of spreading diseases in the process of healthcare delivery. According to Rao (2008: 297) healthcare facilities generate different types of medical waste that can pose an enormous risk to humans and the environment if it is disposed of incorrectly. Hazardous waste is expected to be disposed through approved methods however some finds its way to municipal landfill sites, illegal dumps and within sewage systems. Inadequate knowledge; societal habits and attitudes still dictate against hazardous waste management; current hazardous waste disposal in households needs better regulation and greater public awareness.

2.3 Cradle to grave principle

The Cradle-to-Grave is a global principle that takes into account the socio-economic realities facing the global countries today including South Africa. These realities have precluded unqualified local adoption of principles that have been implemented by developed countries to address the problems caused by HCRW. Determination of this principle should not be seen as in isolation. It is the first step in an ongoing process to develop a national holistic integrated waste management system for South Africa. According to the United Nations Development Program (UNDP), HCRW is the second most dangerous type of waste after nuclear waste because it is harmful to human health and the environment if the Cradle-to-Grave principle is not implemented. The Cradle-to-Grave principle is further supplemented by specific regulations dealing with the control of the transboundary movement of hazardous and infectious waste enabling South Africa to fulfil the requirements of the Basel Convention on the control and disposal of HCRW. Management of HCRW forms a very important subset of integrated waste management that in turn is a subset of pollution control. The principle must thus not only integrate HCRW regulation into the overall waste regulation system but also provide for integration of management and regulatory functions across air, water and soil components of the environment. Since the generation of HCRW is an inevitable consequence of development, it will hardly be possible to eliminate its production altogether.

The Resource Conservation and Recovery Act (RCRA) was passed by the United States Congress to create a reliable system for controlling the process of hazardous waste handling

from when it's generated to its disposal, thus the term "cradle-to-the-grave." The cradle-to-grave principle, also referred to as the life cycle assessment (LCA) is a technique to assess environmental impacts associated with all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling (Finkbeiner *et al*., 2010). Figure 1 1 below shows the cradle to grave process flow:

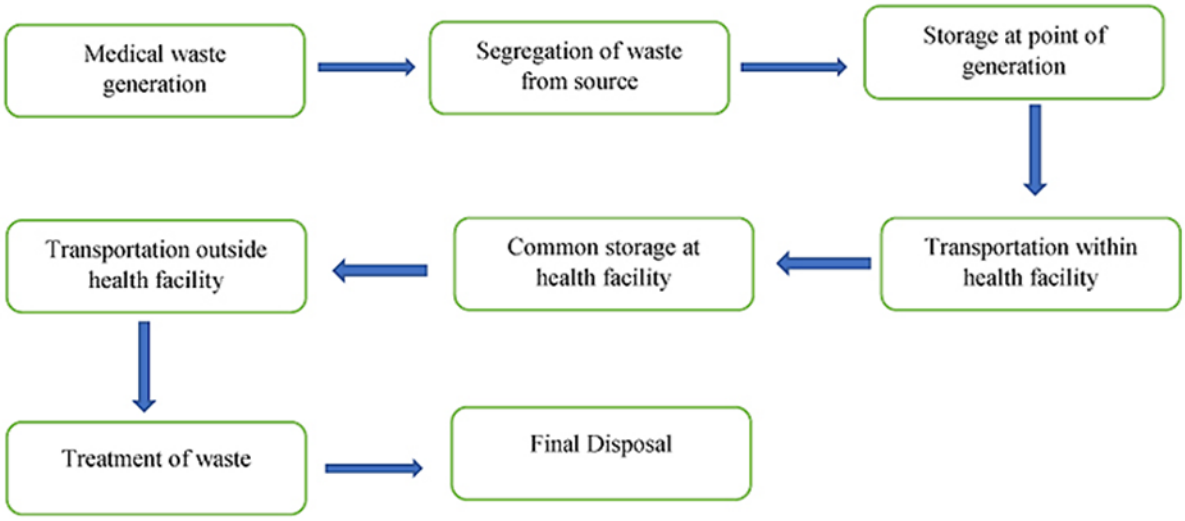

Figure 1 1 "A flow chart showing the medical waste management chain "from cradle to grave"

One of the main purposes of the cradle-to-the-grave concept is to hold hazardous waste generators responsible that their waste will be managed and disposed of correctly. Every hazardous waste generator needs to be held accountable for their waste production to ensure safety to the public, the environment, and themselves. Even when a company hires a waste management organization to work with them, they are still fully responsible that such material is properly taken care of. It's vital that companies comply exactly as expected to avoid facing legal liabilities. Any accidents or damages that occur due to company negligence will require the payment for a response or clean-up, and possibly fines.

2.4 Benefits of correct medical waste disposal

Correct medical waste disposal include correct segregation at source and disposal meaning each waste category must be disposed of correctly according to specific guidelines to protect health

care professionals (HCP), ward cleaners, laundry workers and patients from needlestick injuries and biological hazards. Mathur *et.al.,* (2011) said that an important first step in the correct disposal of medical waste is the separation of waste at the point of generation, followed by its disposal into colour-coded containers. Medical waste in these containers can then be disposed of through incineration, sterilisation, chemical disinfection or burial in a secured landfill. Abor (2007:11) added that sharps, which include hypodermic needles, saws, pipettes, scalpels, broken glass and blades, are disposed of through incineration, chemical disinfection and microwaving. Laboratory waste, which includes body fluids, human tissue and cultures, can be disposed of through incineration or chemical disinfection. Human tissue, body parts, foetuses and cadavers must be disposed of through incineration. It is essential that all medical waste is separated out at the point of generation, appropriately treated and correctly disposed of. According to Mathur *et.al.,* (2011) HCPs have a responsibility to protect the community and other workers by disposing of medical waste correctly. Correct disposal of medical waste requires that HCPs have adequate knowledge of the various disposal methods. All HCPs in South Africa receive training on the correct disposal of medical waste at the medical, dental or nursing schools they attend in order to qualify. Hospital management, as the employer of these HCPs, has a responsibility to provide employees with continuing training in correct disposal methods (WHO, 2012). HCPs also have a responsibility to attend training provided by their employers. WHO (2012) added further that training should include knowledge of occupational hazards, management of exposure to blood and body fluids, correct medical waste disposal procedures, prevention of injury and diseases that could result from handling medical waste, and management of needlesticks injuries. Studies indicate that a number of HCPs in countries such as Ghana, India, Pakistan, Malaysia and SA have inadequate knowledge of the categories of medical waste, correct waste disposal procedures for each category, and the legislation governing medical waste disposal in their countries (Botelho, 2012:98).

Proper medical waste disposal is crucial for preventing the spread of infections and diseases. Improper disposal of medical waste can have adverse impacts on the environment, public health, and safety of healthcare workers. Firstly, correct medical waste disposal helps to prevent the spread of infections and diseases. Improperly disposed of medical waste such as used needles, syringes, and surgical instruments can spread infections such as HIV, hepatitis B and

C, and other blood-borne diseases (Meena *et al.*, 2015). Proper disposal of medical waste reduces the risk of contamination and ensures that hazardous waste is contained and managed safely.

Secondly, proper medical waste disposal protects the environment. Some medical wastes, such as anatomical, chemical and pharmaceutical waste, can be hazardous and harmful to the environment. For example, improper disposal of mercury-containing devices can lead to mercury contamination in water bodies, affecting aquatic life and human health (Cheng *et al.*, 2010). Proper disposal of medical waste can reduce the impact on the environment and ensure safe handling and disposal of hazardous waste.

Thirdly, proper medical waste disposal promotes occupational safety for healthcare workers. Healthcare workers are at a higher risk of exposure to medical waste, and without proper disposal methods, they can be exposed to blood-borne pathogens and hazardous chemicals. Proper disposal of medical waste reduces the risk of occupational hazards and promotes a safe working environment (Basu *et al.*, 2016).

It can then be concluded that correct medical waste disposal is essential for preventing the spread of infections and diseases, protecting the environment, and promoting occupational safety for healthcare workers. It is crucial to have proper medical waste disposal practices in place to ensure the safety and well-being of everyone involved.

2.5 Policies and legislative requirements on medical waste management in South Africa

After South Africa gained its independence in 1994 following the first democratic elections, the parliament developed and drew up a constitution that aimed to protect the rights of all the citizens of the country and explains their obligations. The constitution was then promulgated in 1996. Section 24 of the Constitution of the Republic of South Africa (Act 108 of 1996) states that:

"Everyone has a right to an environment that is not harmful to health or their well-being. The Government is, therefore, obliged to act reasonably to protect the environment by taking appropriate measures to prevent pollution of all types, and to ensure that polluting agents

take precautionary measures to balance industrial development with environmental protection to the mutual and socio-economic benefit of all stakeholders involved."

To achieve this goal, the National Environmental Management Act (NEMA of 1998) provides an over-arching framework towards the attainment of integrated and co-operative environmental governance. Furthermore, this Act supersedes several sections of the Environmental Conservation Act of 1989 and it includes the so-called "Polluter Pays Principle" as well as the remediation of environmental damage (South Africa Year Book, 2000/01). In particular, the Hazardous Substance Act (RSA 1973) as well as the Environmental Conservation Act (RSA 1989) provides for the control of substances which may cause injury or human illnesses due to their toxic and corrosive nature; as well as the regulating of dumping of waste in registered landfill sites, respectively. In addition, the National Environment Management: Air Quality Act (RSA, 2004), provides national norms and associated standards in order to control and regulate air quality monitoring, management of all government spheres involved, the goal being to achieve environmentally sustainable development (Mc Clean, et al. 2003). Table 2-1 below shows a summary of all the regulatory framework that governs the waste management in South Africa.

Table 2-1: Regulatory Framework

CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA ACT 108 OF 1996	The constitution is the principal piece of legislature in South Africa, obligate all activities to take place in accordance with environmentally sound practices to prevent the violation of the environmental right. Local government has to do refuse removal, waste/refuse dumps and disposal.
NATIONAL ENVIRONMENTAL MANAGEMENT ACT 107 OF 1998	The National Environmental Management Act (NEMA) provides for cooperative

	governance. Chapter 3 makes specific reference to the responsibilities of local government with respect to waste management. Chapter 7 imposes a duty of care in respect of pollution and environmental degradation.
NATIONAL WASTE STRATEGY AND ACTION PLANS	The overall strategy is to reduce the generation of waste and the impact on the environment of all forms of waste. Again, concepts such as Integrated Waste Management planning, Waste Minimization and Recycling are emphasized repeatedly.
NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE MANAGEMENT BILL 2007	The Bill has a significant impact on Waste Management in South Africa. It requires municipalities to have a comprehensive integrated waste management plan, and industries to develop an industry waste management plan.
ENVIRONMENT CONSERVATION ACT **73 OF 1989**	The Act specifies the requirement of a permit to establish and operate any waste disposal. The permit sets conditions pertaining to the design, construction, monitoring and closure of a waste disposal site. In Section 20 specific reference is made to waste management, including the establishment and operation of waste disposal sites.
MUNICIPAL SYSTEMS ACT 32 OF 2000	The Act regards Municipalities as service authorities, responsible for the effective delivery of services and must provide

	appropriate policy and regulatory frameworks.
NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT 39 OF 2004	The Act deals with the control of ambient air quality. It clearly spells out the responsibilities of each sphere of government in ambient air quality management.
NATIONAL WATER ACT 36 OF 1998	The Act contains provisions directly addressing waste management operations that impact on a water resource.
WHITE PAPER ON INTEGRATED POLLUTION AND WASTE MANAGEMENT FOR SOUTH AFRICA, NOTICE 227 OF 2000	In this document the focus is shifted towards integrated pollution and waste management, as well as waste minimization. Concepts such as cradle-to-grave, waste minimization at source and integrated waste and pollution management are emphasized throughout.

Schedule 4, of the South African constitution states that, the government at the national level is responsible for providing health services and protecting the environment. Departments that play a role in ensuring that HCW is managed properly are the Department of Environmental Affairs and Tourism, the Department of Health, the Department of Labour and the Department of Agriculture and Land Affairs. In schedule 5 (B), the constitution states that the local government has authority to govern and pass by-laws regarding air pollution issues, municipal health services, refuse removal, refuse dumps and solid waste disposal among others (Republic of South Africa, 1999). Considering the fact that various organs of states are involved in regulating health care waste management in the country, it is possible for such organs to suffer from lack of collaboration and cooperation. This could also delay the implementation process.

South Africa does not have any national policy governing HCW since 2000. In the absence of this national policy, some provincial governments took the initiatives of develop regulations that address HCW management to comply with the constitution of the republic. Some of the

provincial governments that developed the regulations include Gauteng, Western Cape, Mpumalanga and Limpopo. The Gauteng Health Waste Management Regulations were passed in 2004 and the Western Cape Management Draft Bill was published in 2005 for comments.

The South African Bureau of Standards (SANS) was established in 1945 and it developed various standards like SANS (10248) in 2004 to assist in regulating HCW in SA. The South African Standards Act of 2008 mandates the establishment of a national body that develops, maintains and promotes the standardisation of services for the management system, product testing and certification. The South African national policy on medical waste management called National Health Care Waste Management Policy was then drafted in 2008 however 15 years later, this policy is still a draft document.

2.6 Medical Waste Management Best Practice

The World Health Organization (WHO) prescribed that medical waste should be segregated and disposed of into separate waste containers from the source, and afterwards stored in a safe place inaccessible to rodents and unauthorized people for a maximum of 48 hours and then transported to the treatment or disposal site (WHO, 2005). If this guideline is strictly followed, the quantity of medical waste which is eventually passed to treatment/disposal facilities will be small and manageable.

The selection of the techniques, technologies and management programs to achieve waste management objectives is called integrated waste management (IWM). The waste management hierarchy shown in Figure 1 2 below shows a systematic and holistic approach to waste management during the waste life cycle, which in turn addresses reduction, avoidance, reuse, recovery, treatment, recycling and safe disposal to implement IWM (DEA, 2011: 6; DEA, 2012:279)

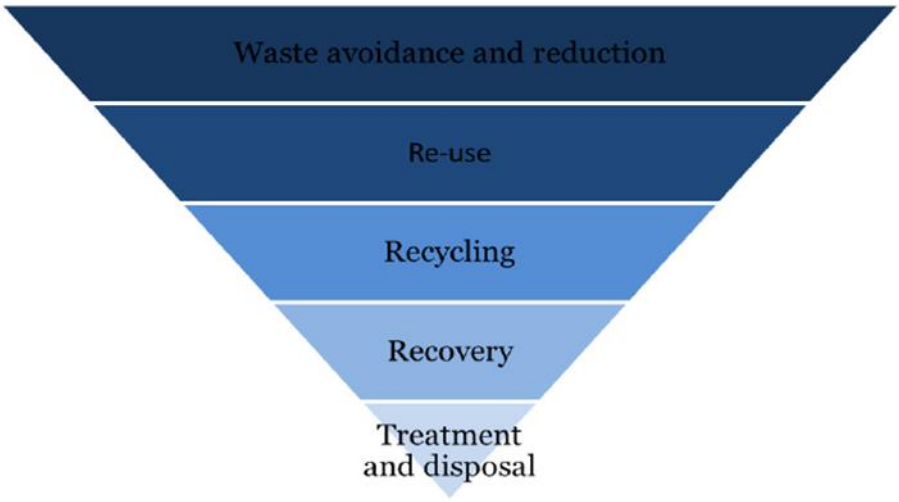

Figure 1 2 Illustration of the waste management hierarchy (Van Jaarsveldt, 2016:16).

2.6.1 Waste avoidance and reduction

This first step in the waste management chain is the most important step because it determines the eventual quantity of waste that is to be treated and disposed of. Waste avoidance and reduction is the foundation of the waste hierarchy and is the preferred choice for waste management measures. The aim of waste avoidance and reduction is to achieve waste minimization and therefore reduce the amount of waste entering the waste stream. This is especially pertinent for some waste streams where the recycling, recovery, treatment or disposal of the waste is problematic. Waste avoidance can be achieved in different ways, such as the prevention of waste at a point of generation through cleaner production or cleaner technology. These technologies mainly involve the use of good quality raw materials and the generation of very small amounts of by-products or no by-products at all. It is also achieved through strong legislative measures for waste reduction (Sharma & Jain 2019:145). According to Sugni *et al*., (2005), priority should be given mainly to the avoidance of waste generation, and it must be a priority before the other three measures that can be applied to ensure the best management of waste, while waste disposal is the last priority.

2.6.2 Recover, re-use and recycling

Also known as waste minimisation. The primary goal of waste minimization is to reduce waste quantities that could otherwise be transported and disposed of in the landfill sites. Waste minimization is also called resource recovery or waste reclamation (DEAT,2002a). Traditionally, the practice focused more on material reclamation from disposed waste in the landfill sites. This was uncontrolled, and informally done by reclaimers who were mainly from economically disadvantaged communities. There is an indication; however, that municipalities, private industries, and communities are starting to give support to initiatives of resource or material recovery. This involves amongst others, biodegradation, bio stabilization, bio drying, composting and energy generation from landfill gas, as well as other advanced technologies (DEAT, 2002a).

Recovery of waste at the source is strongly recommended, but it can also be done during transportation or at the disposal site. However, the earlier the separation, the cleaner the material, and ultimately, the higher its quality and the economic value of recyclables. When waste recyclers are allowed access to landfill sites, significant amounts of material are recovered. However, because they interfere with efficient operation of dumps and landfills, recyclers are usually prohibited, yet in turn it leads to lowering recovery rates and causing severe economic hardship in local communities.

Several literature reviews indicated that different countries use different methods to recover and reduce waste quantities. The focus is often to reduce waste quantity. Quantity reduction measures are aimed towards minimizing the amount of waste generated, while quality reduction ones attempt to lessen toxic levels (Kassim & Ali, 2005; Sugni *et al.,* 2005). Whereas the emphasis in most countries is to recycle only general waste, industrialized countries such as Korea, also attempt to recycle hazardous waste. For example, some of the health care waste, such as human placentas, are recycled in Korea and are used as raw material in the production of pharmaceutical products (Yong-Chung *et al.,* 2005).

2.6.3 Techniques for Medical Waste Treatment and Disposal

After the above priorities of the waste management hierarchy are applied, the final and last option in the hierarchy is waste disposal. Waste disposal is done in various ways, such as the landfill method, incineration, encapsulation and others. The World Health Organization recommended that the choice of the mode of treatment and disposal of medical waste should be guided by cost-effectiveness, easy implementation and environmental friendliness (Hossain *et al*., 2011). The unique characteristics of the constituent of medical waste make it imperative that it be treated effectively before final disposal to make the end-product of the waste safe to the handlers and the public. Different modes of treatment have been employed for specific constituents of medical waste. That is why segregation at the point of generation is vital to make it easy for each group of waste to be passed to their different treatment sections. Final disposal is usually in a landfill. The techniques which have been documented for treatment and disposal of medical waste include:

- **Open dumping/burning:** This method is widely employed in many developing countries because it is cheap and easily available. However, open dumping/burning constitute a great risk to the public because it renders the dumped waste accessible to the public and scavengers. Burning is usually used to reduce the volume of waste and prevent its spread. However, toxic gasses can be released into the atmosphere during the burning process. The waste dump is also usually a source of injury to the community whether through direct contact or indirectly through land, water and air pollution.

- **Incineration:** This is the choice of treatment for pathological wastes, sharps and other clinical wastes that cannot be reused, recycled or disposed of in a landfill. A standard incinerator uses high temperature to convert the waste into a minimal residue in the form of residual gases and ashes [Hossain *et al.,* 2011]. However, many incinerators being used in developing countries are made locally, designed poorly to use coal as fuel and are unable to achieve complete combustion of the waste; thus, resulting in an enormous quantity of ash (Dlamini *et al*., 2019). The unburned waste and ashes are eventually disposed of at a landfill. In general, incinerators are used for the treatment of hazardous waste substances, mainly toxic industrial and healthcare waste. Although, incineration has become a popular means of waste disposal, especially in countries where land is

scarce, it is also accompanied by the release of high levels of carbon monoxide, hydrogen chlorine, metallic (e.g. lead, arsenic, cadmium & mercury) and particulate matters into the natural and human environment. These by-products result mainly from incomplete combustion in incinerators. The emission, movement, and circulation of these pollutants in the biosphere often produce negative environmental and health impacts. Furthermore, the release of greenhouse gases from incinerators is currently contributing to climate change in the form of global warming, which has adverse effects for human settlements and environmental quality. More seriously, such pollutants have been negatively implicated in a variety of acute, chronic and/or sub-chronic illnesses because they have the properties of carcinogens, teratogens as well as mutagens (Yong-Chung *et al.,* 2005).

- **Autoclaving:** A cheaper alternative treatment method to incineration is autoclaving. Autoclaving sharps and medical wastes contaminated with blood and other human secretions at an optimum temperature of 160°C help to rid the waste of bacteria. However, the autoclaved waste still needs to be retreated using another means before final disposal (Dlamini *et al*., 2019). Besides, there is a limit to the type of waste that can be autoclaved – large quantities of waste, large body parts and waste from chemotherapy treatment cannot be autoclaved because of the length of time required for the wastes to achieve the required optimum temperature [Hossain *et al.,* 2011].
- **Microwave disinfection:** This is a modification of waste autoclaving which involves the use of microwaves to provide heat for disinfection of medical waste. However, wastes containing metal objects cannot be microwaved to prevent the generation of dangerous sparks.
- **Landfilling:** Standard landfilling requires more than a simple burial of waste in a shallow pit, it must be located and constructed in an authorized site approved by the government and not within the reach of unauthorized persons. However, in many developing countries, landfills are operated like open dumping where all forms of waste are dumped and later burned [Hossain *et al.,* 2011]. Where the landfill is not properly constructed, erosion may cause the washing of the waste into water bodies, thus contaminating the water.

2.7 Household medical waste management Internationally

In the United States of America (USA), household medical waste management is regulated by both federal and state laws. The federal government has established guidelines for the disposal of medical waste, while individual states have their own regulations and guidelines. The Environmental Protection Agency (EPA) regulates medical waste under the Resource Conservation and Recovery Act (RCRA), which requires medical waste to be treated before disposal. Some states, such as California, have stricter regulations than the federal government, requiring medical waste to be tracked from the point of generation to disposal. It is estimated that 1 in 12 households in the USA use a syringe for the treatment of diabetes, migraines, allergies, infertility, arthritis, osteoporosis, HIV, hepatitis among other conditions. Ideka (2014) alludes that this inadvertently increases the use of injectable medications and the devices often end up in trash. Patients can seek early discharge from hospital admissions to reduce costs or wish to return to their families and opt to be cared for at home. Vollmer (2010) adds that where medical care is provided in the household, medical devices used are ultimately discarded in household bins. Medicines left over from previous use or expired ones are often discarded in household bins.

In the United Kingdom, household medical waste management is regulated by the Environmental Protection Act 1990 and the Controlled Waste Regulations 2012. Medical waste is classified as hazardous waste and must be treated before disposal. Local authorities are responsible for the collection and disposal of medical waste from households. Sharps boxes, which are used to dispose of needles and other sharp objects, are provided free of charge to households by local authorities. The National Health Service (NHS) is in charge of collection of medical waste from pharmacies that were returned by households and residential homes [gov.uk, 2021]. However, despite the clear policies and accessible information, a poll conducted in 2010 by the European Environmental Agency (EEA) showed that on average 50% of the expired or unused drugs are not returned to pharmacies, and are flushed down toilets or sinks (Vollmer, 2010). In contrast, Sweden has had a take-back program for unwanted medicines in place for decades and an estimated 73% of Swedish return unused medicines to pharmacies. These are eventually incinerated at high temperatures and the residue deposited in specified landfills (Tong *et al.*, 2011:17). Consequently, environmental contamination with pharmaceutical products is less likely to cause much concern in Sweden. According to the

Royal College of Nursing, in the United Kingdom (UK) health care staff working in the community are responsible for managing the health care risk waste that they generate and are required to fully comply with duty to care. In Japan and UK, health care risk waste generated by care givers is either left in a safe and secure place in the house where it was generated to be collected by designated contractures; or collected and transported in an approved container by caregivers to health care facilities.

In China, household medical waste management is regulated by the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste and the Measures for the Management of Medical Waste. Medical waste must be segregated from other types of waste and disposed of in designated facilities. The Chinese government has established a classification system for medical waste, with different disposal methods for each category. Local authorities are responsible for the collection and disposal of medical waste from households.

A study on clinical waste management in an HIV/AIDS home based care program in Botswana, reports that stigma associated with red medical waste bags discouraged some primary caregivers (individuals or family members who stay with a client) from conveying the waste to the clinic (Chibamba, 2013). In that study, waste was reportedly discarded in council bins, in a nearby bush, burnt or buried clandestinely. A major safety concern is that of transmission of blood borne viruses such as HIV, Hepatitis B and Hepatitis C viruses, through needle stick injuries. A recent analysis of 21 studies on community acquired needle stick injuries (CANSIs) and their outcome(s) documents six cases of blood borne virus transmission attributed to CANSIs [Hossain *et al.,* 2011]. All patients developed hepatitis, but no cases of HIV transmission were documented [Hossain *et al.,* 2011]. In most of the infected cases, delayed or absent immune prophylaxis appears to have enhanced vulnerability.

Burning waste generated from healthcare activities in the household contributes to environmental pollution by the release of toxic air emissions. Burning plastics widely used for disposable materials and chlorinated materials are major sources of dioxins. Dioxins are a common term for chemical compounds consisting of chlorinated dibenzo-furans and dibenzo-dioxins known to be toxic and to have carcinogenic potential (Nieuwoudt *et al.,* 2009).

However, the relatively small quantities of waste generated from healthcare activities in households are likely to emit lower concentrations compared to other sources of these materials. Leaching of toxic heavy metals and chemicals from solid medical waste (SMW) into the soil occurs in poorly engineered landfills and dump sites. These are ultimately absorbed in the food chain and consumed by man. In addition, leachate can percolate through the soil and contaminate surface and groundwater supplies posing threats to human health by consumption of unsafe water. Although, the contribution of leachate from home generated solid medical waste can be considered minimal relative to hospital waste, it poses a potential hazard to the environment and human health. The consequences of inadequate management of solid medical waste are not limited to patients, their relatives, and health care workers but affects waste workers, scavengers, and the unsuspecting public. The present study aimed to (i) investigate disposal practices relating to waste generated from healthcare activities in the household and (ii) document reported harm associated with this waste in Gauteng, Tshwane Region.

2.8 Household medical waste management in South Africa

The World Health Organization (WHO) defines a health system as "all the activities whose primary purpose is to promote, restore or maintain health" (WHO 2000a:5). South Africa, like many other countries, grapples with the challenge of managing medical waste generated within households. The history of medical waste management in South Africa dates back to the colonial era when rudimentary healthcare practices resulted in the disposal of medical remnants within domestic settings. However, the modernization of healthcare infrastructure in the 20th century led to a surge in household-generated medical waste, necessitating systematic approaches to waste management. The apartheid era further exacerbated disparities in waste management infrastructure, with marginalized communities bearing the brunt of inadequate disposal facilities South African's health services are divided into four levels of care: primary, secondary, tertiary, and academic. Primary level of care includes rural health centres (RHCs) and community-based health services. There are also government, private sector, mission and municipal clinics at this level. The district hospitals fall within the secondary level of care. The tertiary level consists of provincial hospitals, and at academic level, are central hospitals. The system is organised in such a way that rural health centres refer patients to district hospitals, which in turn refer them to provincial hospitals. The provincial hospitals then refer patients to

academic hospitals. However, there are situations where referrals do not follow this pattern, due either to the close proximity or the distant location of the large health institutions, and also due to lack of qualified health care professionals. The other reason for the break in the referral pattern may be due to the non-availability of advanced equipment at many institutions that are lower than the tertiary level. In addition to municipality and government health facilities, there are private clinics and hospitals catering for the middle- and upper-class members of society. Large corporate companies operate their own clinics and hospitals, mainly offering services to company employees and their dependents. Community based health services compliment services offered in all levels of health care. The South African health system is struggling to accommodate the growing number of the population and the burden is also worsened by the illegal immigrants that fled from the neighbouring countries and the world for various reasons like economic growth; hunger and fled from war zones. The health sector has developed and adopted several policies, strategic plans and guidelines to ensure standardised care and treatment, as well as to guide implementation of health service delivery by the public and private sectors. Two policy documents that are relevant to this study are described below. Other important policies and guidelines will be referred to in relevant sections of this study.

South Africa is one of the countries experiencing faster economic growth in the Southern African Development Community (SADC). Unfortunately, most developing countries, like South Africa, are focusing mainly on growing the economy, than on environmental quality. According to Olaniyi *et al*., (2021:76), SA generate 42,200 tons of HCRW per year. Department of Environmental Affairs and Tourism (DEAT) statistics indicates that majority of this waste is generated by the healthcare facilities and only 4,500 tons are hazardous however because the waste is all mixed together, it becomes necessary to treat it as hazardous and cannot be recycled and reused without pre-treatment. The South African Constitution stipulates that everyone has "*a right to an environment that is not harmful to his or her health and well–being"*. Home-based care is a crucial component of healthcare delivery, particularly in resource-constrained settings like South Africa. However, one often overlooked aspect of home-based care is the management of medical waste generated in these settings. Medical waste from home-based care poses significant health and environmental risks if not properly managed. This literature review aims to explore the history, challenges, regulatory frameworks, health implications, and sustainable management practices of medical waste generated from homes by home-based caregivers in South Africa. In developing countries like According to Mosia (2006), South

Africa, where health concerns are competing with limited resources medical wastes generated from the households have not received sufficient attention and the priority it deserves. According to the department of health, home-based caregivers provide different types of services depending on the needs of the patient. The services are nursing care, physical care, patient support, psychological care, and domestic chores for their patients. The services that generate health care risk waste are nursing care and physical care. These hazardous and medical wastes are still handled and disposed- off together with domestic wastes, thus creating a great health risk to municipal workers, the public, and the environment (Nkosi, 2014). A poor knowledge of the characteristics of medical waste may be responsible for the poor segregation practice. The proper collection and disposal of this waste is of great importance as it can directly and indirectly impact the health risks to both public and the environment. While researchers have underscored the challenges associated with waste management in healthcare facilities, the waste that emanates from home-based care settings should be of greater concern because unlike in hospitals, homes are not built to accommodate medical waste. Unfortunately, practical information on this important aspect of healthcare management in South Africa is inadequate and research on the public health implications of poor management of healthcare wastes are few and limited in scope. Hangulu and Akintola (2017:17) alluded that the waste generated by home-based caregivers in SA is managed in the same manner as general domestic waste.

According to Hangulu and Akintola (2017), almost all health care risk waste generated in homes is still included in general household waste in developing countries like South Africa. This practice results in health care risk waste mismanagement. The mismanagement causes immense health challenges, which is a cause for concern because health care risk waste is infectious states Udofia *et, al.,* 2017). Challenges in medical waste management in home-based care settings are multifaceted. Limited resources, inadequate infrastructure, and a lack of awareness among caregivers contribute to improper disposal practices. The impact may be direct or indirect. The direct impacts on health are through needle stick injuries, transmission of infectious agents (Cruvinel *et.al.,* 2016). The impacts may arise from collection, handling, transportation, treatment or the disposal of waste. The health risks occur as a result of infection or injury mainly on healthcare workers, volunteer caregivers, and others who are involved in collecting, handling, transporting, or disposing of the wastes (Cruvinel *et.al.,* 2016). Needle-stick injuries has been reported to be the top three leading causes of injuries affecting waste workers (Akintola 2017:17). Waste workers are injured when handling domestic waste.

The indirect impact on health is through environmental contamination. Health care risk waste such as faeces and urine contain disease causing micro-organisms. If the health care risk waste is untreated, it may spread infection through contaminated water. People, animals, birds that scavenge at disposal sites may be infected (Kang'ethe, 2007:8). Drinking of water contaminated by health care risk waste may cause diarrheal diseases. Diarrheal diseases are a huge health challenge in South Africa (Phorano et.al, 2005:7). It is estimated that contaminated water, inadequate sanitation and poor hygiene cause over 80% of all diseases in developing countries. The most common diseases emanating from mismanagement of health care risk waste such as feaces and urine are dysentery, typhoid, bilharzia, malaria, cholera, parasitic worms (Chartier *et.al*., 2014). Over and above the diseases that are caused by improper management of health care risk waste due to poor sanitation, there are diseases like HIV/AIDS, skin infection, infectious hepatitis that may spread within communities from infectious health care risk waste. Mismanaged health care risk waste further provides suitable breeding ground for vectors which spread diseases. Examples of the potential infections caused by exposure to health care risk waste, their causative organisms, and transmission vehicles (Chartier *et.al*., 2014). Improper management of medical waste can have severe health implications for caregivers, patients, and the community. Mmereki et al. (2018), have also identified microbiological contamination in medical waste from home-based care settings, emphasizing the potential for disease transmission. Sustainable management practices, including segregation, safe storage, and proper disposal, are essential for mitigating these risks. Educational interventions, such as those evaluated by Dlamini et al. (2021), have shown promise in promoting sustainable medical waste management practices among home-based caregivers in South Africa.

Home-based care is a primary health programme and is recognised as the most cost-effective strategy for delivering essential health care programmes to communities (Willcox *et al.*, 2015). Services that are offered are nursing care, physical care, patient support, domestic chores, and psychological care. Nursing care includes dressing wounds, administering medication, and supervised treatment support (directly observed treatment support). This waste generated from processes is either discarded in an open field, burnt, buried in shallow graves or collected by or on behalf of the local authority to be disposed of in solid waste land fill sites (Hangulu and Akintola, 2017:17).

Caniato *et al.*, 2015 states that in South Africa (SA), like in most developing countries, there is inability to effectively manage the household medical waste due to lack of resources; poor management of available resources and lack of transparency in administration.

2.9 Possible impacts that can be caused by incorrect medical waste disposal

Incorrect disposal of health care risk waste has a direct and indirect impact on health and the environment. The indirect health impact generally occurs from needle stick injuries as seen in Figure 2-3 below leading to the transmission of infectious agents. According to Motlatla (2015), these impacts generally occur as a result of waste management activities such as collection, handling, transportation, treatment, or disposal of waste. Zikhathile and Atagana (2018:15) indicates that the indirect impact on health results from the environmental contamination, land and water, caused by untreated health care risk waste. Health care risk waste contaminated environment cause diseases such as dysentery, typhoid, bilharzia, malaria, cholera, and parasite worms. Indiscriminately disposed health care risk waste provides breeding grown for disease cause vectors that spread diseases. It has been established that, worldwide, about 5.2 million people (including 4 million children) die each year from waste related diseases. The hazards of exposure to hospital waste can range from gastro-enteric, respiratory, and skin infections to more deadly diseases such as HIV/AIDS, and Hepatitis (Babanyara *et al.*, 2013:11). Additionally, medical waste contains potentially harmful micro-organisms which can infect hospital patients, health-care workers and the general public. Other potential infectious risks may include the spread of drug-resistant micro-organisms from health-care establishments into the environment.

The type of injuries that may be caused by the Waste and by-products includes but not limited to the following:

- Radiation burns;
- Sharps-inflicted injuries, as shown in Figure 1 3 below;
- Poisoning and pollution through the release of pharmaceutical products, in particular, antibiotics and cytotoxic drugs;
- Poisoning and pollution through waste water; and

- Poisoning and pollution by toxic elements or compounds, such as mercury or dioxins that are released during incineration.

Figure 1 3 Needle pierced a person's shoe in the landfill.

2.10 Causes of incorrect waste disposal

Health care risk waste management in a safe and efficient manner is important and it is the responsibility of all generators, including home-based care givers. This is for the protection of the environment, preservation of human health, and to comply with all waste management laws such as the National Environmental Management: Waste Act. The irresponsible and illegal disposal of home generated health care risk waste places an unacceptably high financial and human resources burden on the South African government to manage the problem (Dlamini *et al*., 2019). The environmental justice movements say that the practice of health care risk waste mismanagement economically and socially disadvantage communities that are already poor (Dlamini *et al*., 2019). The economically and socially disadvantaged communities are the non-white, poor, less educated, and politically less powerful. This is the previously disadvantaged group. These are the people that are already burdened by disease such as HIV/AIDS and opportunistic infections. The factors contributing to health care risk waste mismanagement range from ignorance, lack of capacity and resources, attitude, cultural beliefs, lack of support,

and irregular waste collection by waste collectors. Some common causes of incorrect waste disposal include:

- Lack of Awareness and Training - waste generators, including healthcare facilities, may not be adequately aware of the potential risks associated with incorrect waste disposal or the proper methods for waste segregation and disposal (Kaiser *et al.,* 2016). Some of the health care risk waste knowledge by caregivers is self-taught and such training is usually not accurate. Caregivers are not provided with training specific to health care risk waste. Some of the training received by caregivers incorporated aspects of health care risk waste but were not specific to health care risk waste.
- Inadequate infrastructure and facilities - lack the necessary waste management infrastructure and facilities, making it challenging to handle waste properly (Verma & Yadav, 2017).
- Financial Constraints - proper waste management can be expensive, and some institutions or waste generators may be reluctant to invest in adequate waste management systems (Cheng *et al.,* 2018).
- Inadequate Regulations and Enforcement - poor enforced of waste management regulations can result in non-compliance and incorrect waste disposal practices (Aramesh *et al.,* 2017).
- Cultural and Behavioral Factors - cultural attitudes and behavioral practices may also contribute to incorrect waste disposal, especially in regions where waste management is not given high priority (Nzediegwu & Chang, 2018).
- Lack of Monitoring and Accountability – lack of monitoring and accountability mechanisms can lead to negligent waste management practices (Karki *et al.,* 2019).

Addressing these causes through education, improved infrastructure, better regulations, and increased accountability can help in promoting proper waste disposal practices and reducing the negative impacts on public health and the environment.

2.11 Chapter summary

This chapter looked at the history; objective and advantages of the home-based care; the legal framework around waste management and what are the issues around waste management practice that have a potential to render waste management ineffective. This chapter elaborated on the cradle-to-grave principle process flow; the importance og correct waste disposal and the impacts of incorrect waste disposal. The chapter reviewed the household hazardous waste management practice around the world and compared to the South African context to see where South Africa is lacking in order to be on the same standard as the international best practice. Both the international and the local literature on household hazardous waste management was reviewed using various case studies and it showed that there has been difficulty in reaching a consensus on how to manage this waste. The next chapter will look at the research methodology that was used in data collection and data analysis of the empirical investigation of this study.

CHAPTER 3

3.1 Introduction

The previous chapter, Chapter 2 reviewed literature about household hazardous waste management and the South African legal framework about medical waste. The chapter also look at the international best practise on handling the medical waste. Chapter 3 discusses the chosen research methodology, the methodology techniques that was used to answer the research questions and why that methodology was chosen by highlighting the methodology's strengths. In this chapter, a detailed overview on how the data was collected, and how the sample was selected will be discussed. This chapter will also discuss the importance of a sample size and lastly, how the research was conducted and feedback from the participants was analysed.

3.2 Research design

Research is defined as a "systematic and redefined technique of thinking, employing specialised tools, instruments, and procedures in order to obtain a more adequate solution of a problem than would be possible under ordinary means" (Crawford in Singh, 2006:5). Research starts with a question, collects data or facts, and then analyse that data to arrive at a decision based on factual evidence. According to Maree (2016:246) there are four (4) research methodological approaches researchers use when conducting research, namely:

- A Qualitative research approach which is a rigorous approach to finding answers to research questions through process observation and spending extensive time in the field;
- A Quantitative research approach is research that uses evidence from surveys to either support or refute hypothesis;
- A Mixed-methods research approach that combines both qualitative and quantitative research approaches; and
- A Multimethod research approach which involves multiple studies of either qualitative or quantitative and mixed methods research approaches.

Within each of these abovementioned research approaches, researchers can choose their own design that is more aligned to their research topic. Research methods consist of three (3) stages,

namely: (1) forms of data collection; (2) analysis; and lastly (3) interpretations that the researcher propose for their studies. This research will follow an inductive research approach, which is an approach that uses examination and trend analysis from the data collected to observe a social phenomenon (Braun and Clarke, 2012:57). Inductive research approaches allow the researcher to use existing theory to formulate research questions (Saunders *et al.,* 2012:157). A qualitative research approach was selected as the best research methodological approach, because it offers an objective approach to experiment, while remaining in the background since the research is to explore the management of medical waste generated in the households. The next section will give a detailed discussion on the data collection.

Research methods of collecting data for this research study had two approaches, using the primary data sources and secondary data. Research methods for this research using primary data include two instruments: questionnaires and interviews. Semi-structured interviews were designed for the home-based care managers. The secondary data was obtained from literature review of books; journal articles; government publications and the internet. The investigation of the literature sources was necessary as it gave the framework for this research and validated the need to conduct this research and made the researcher aware of the similar research taking place.

In the first qualitative phase of the study, the objective, was to understand the home-based care phenomenon, the knowledge of care givers on health care risk waste, identify the activities carried out by care givers that lead to health care risk waste generation, and the attitude of care givers toward health care risk waste issues.

3.2.1 Study area

A mixed method approach was employed to collect both qualitative and quantitative data from 4 home-based care giving facilities in Tshwane region of Gauteng Province, South Africa. Gauteng Province is located at the centre of South Africa, covers an area of 18,176 square kilometres with a population of about 12.3 million. It is the richest province in South Africa. Gauteng is divided into five district municipalities (see Figure 1 4), namely the City of Johannesburg (CoJ), West Rand, City of Tshwane (CoT), Ekurhuleni and Sedibeng. These district municipalities were demarcated as directed by the Local Government Municipal Structures Act (1998). Three of these districts, namely CoJ, CoT and Ekurhuleni are classified

as metropolitan areas. The selected facilities in Tshwane are from the township and the suburbs around the Tshwane region. The term township within the context of South Africa refers to underdeveloped and developing residential areas that during the apartheid system were reserved for non-whites (Africans, Coloureds and Indians) who lived and worked in areas that were designated for "white only" people (Pernegger & Godehart, 2007).

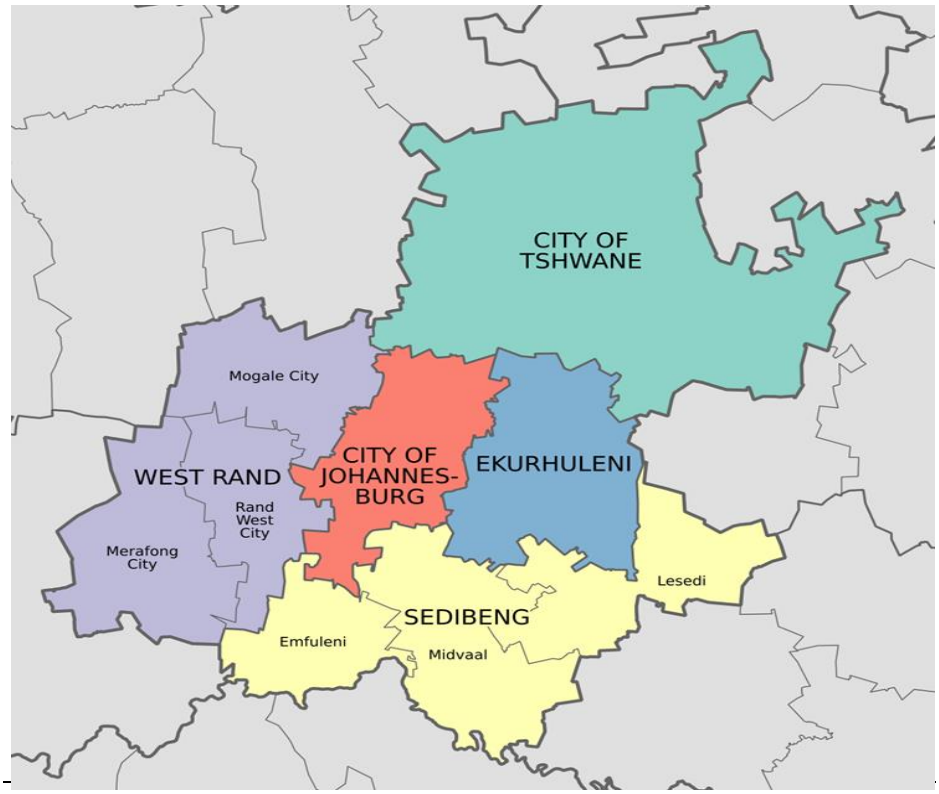

Figure 1 4 District municipalities in the Gauteng province.

3.2.2 Sampling

The field visits for data collection were between October 2023 and January 2024, using pre-designed open (semi-structured) and closed-ended (structured) questionnaires. The clinics were selected randomly and localities in the study area. An eligible respondent was aged 18 years or older to ensure that they were mature enough to participate in the study.

The questionnaires had closed format questions and contained five sections: demographics of caregivers and their patients; home-based care services; protective clothing, different types and quantities of generated waste; management practices of the generated waste; and types of training received. The language of communication was English or the local dialect where this was preferred.

3.3 Literature review

To answer the research objectives that was set earlier in Chapter 1, this section focuses on the data collection methods that were utilised in order to answer the set research objectives, firstly by conducting and extensive literature review, and secondly by conducting an empirical investigation to explore the perspectives of the home-based care givers.

3.3.1 Empirical investigation: A qualitative approach

A qualitative research approach is described as "a type of research that focuses on quality such as words or observations that are difficult to quantify and that lend themselves to interpretation or deconstruction" (Glesne, 2011:283). Sutton and Austin (2015) stated that qualitative research is concerned with how human behaviour can be explained within the framework of the social structures in which that behaviour takes place. Rosenthal (2016) added that qualitative research aims to gain an in-depth understanding of a specific organization or event instead of a shallow, brief of a large population. Qualitative research, also called 'field research', is about selecting and recording behaviours of people in the environment using an instrument called a questionnaire (Ravindran, 2019:40). It is about understanding human behaviours through non-numeric data (Schwandt, 2007:12). For the purposes of this research, an 'Action Research Spiral Process', also known as a 'participatory process' was used.

The use of the questionnaire in the Action Research Spiral Process was chosen as the best way to assist with this research topic. The questionnaire was structured into two sections, i.e. Section A was about the participants' background, and Section B, was about the participants' experience with regards to medical waste management. Lune and Berg (2017:139) described the Action Research Spiral Process as "a kind of self-reflective enquiry undertaken by participants in a social relationship with one another in order to improve some situation or

condition with which they are involved". The Action Research Spiral Process was chosen for this study, because of its two distinct purposes which are firstly to produce new information and knowledge that will be useful to the selected group of people, and secondly to motivate and encourage an average person in the research group to take up the new information and knowledge from the research and use it (Johnson, 2008). According to Lune and Berg (2017:137) as illustrated in Figure 1 5 below, the qualitative research approach consists of four steps in the

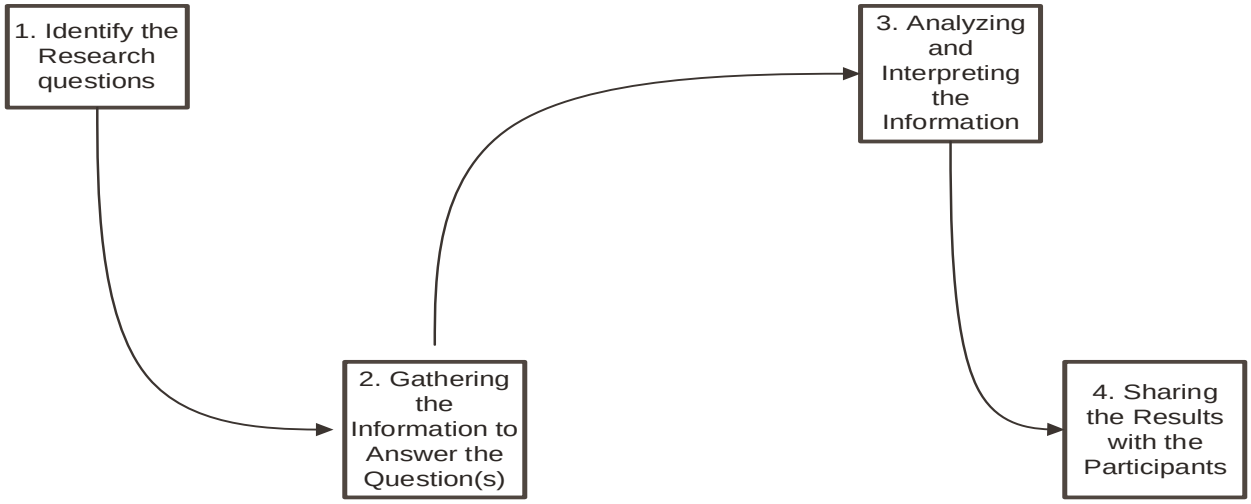

Figure 1 5 The Action Research Spiral Process (Adapted from: Lune and Berg, 2017:139).

3.3.1.1 Step 1: Identify research questions

The primary method of data collection used for this research study was through the use of questionnaires. Questionnaires are used in a wide range of settings to gather data about the opinions and behaviours of consumers (Sutton and Austin, 2015). For this study, data was collected in the form of a self-administered structured questionnaire to gain insight and an understanding of the perspectives of South African home care givers on how the manage medical waste generated during their sessions. An abbreviated sample of the questionnaire is provided in Table 3-1 below. An example of the full questionnaire is also included in Annexure A at the end of this research study.

Table 16-1: Abbreviated version of the questionnaire (Own Contribution).

Sections	Contributing questions to the sections
A: HCG Background and experience	A1. What is your highest level of qualification? A. *Grade 12; B. Auxiliary certificate; C. Nursing degree; D. Other.* A2. How many years of working experience do you have in Home-based care giver (HCG)? A. *1-5 years; B. 6-10 years; C. 11-15 years; D. More than 15 years*. A3. In which sector did you gain experience in HCG? *A. Private sector; B. Public sector; C. Other.* A4. How much formal assessment/training do you have in HCG? *A. Extensive; B. Moderate; C. Little; D. None.*
B: HCG Waste management	B1. Did you receive medical waste management training? *A. Yes; B. No; C. Something like that.* B2. From your experience, do you think medical waste management training is important? *A. Strongly agree; B. Slightly agree; C. Slightly disagree; D. Strongly disagree.* B3. From your perspective, what is the goal of HCG waste management training and do you think it is achieving what it is set out to achieve? B4. How do you dispose of the medical waste that was generated during each visit? *A. In the patient's domestic bin; B. Take it back to the clinic/hospital.* *B5*. From your experience, what are the most important shortcomings in waste management that might be an obstacle towards its effective management? B6. From your perspective, what can be done to improve medical waste management in South Africa?

The questions in the questionnaire for this research was formulated based on the issues raised in the literature review conducted in Chapter 2. The questionnaire consisted of 10 questions in total consisting of open- and close ended questions, respectively. Additionally, the questionnaire was divided into two (2) sections for participants to self-administer. The first

section (Section A), (Questions A1–A4) was aimed to determine the background information and experience of the South African home care givers that participated in this study. This was followed by the second section (Section B) which focused on the perspective and experience of the participating home care givers on the management of medical waste (Questions B1–B6).

3.3.1.2 Step 2: Gather the information to answer the questions

The questionnaire was sent to the government clinics in the selected study area because according to Hennink and Kaiser (2020:490) to increase the sample size during distribution is a common way to save time and to ensure that minimum sample target is met. Hennink and Kaiser (2020:490) describes data saturation as "the point in the research process when no new information is discovered in data analysis, and this redundancy signals to researchers that data collection may cease". Data saturation is an important tool in snowball sampling because it provides data validity and is often included in qualitative research to assess the quality of the research (Hennink and Kaiser, 2020). A detailed discussion on sampling will be discussed in this chapter under the sampling section. Fusch and Ness (2015) say there is "no one size fits all" in data saturation because it is a difficult concept to define and there are no universal study designs. The invited participants were initially given two weeks to respond, however because of a poor responding rate during this timeframe, this was later extended with another one week. At the end of that extended week, a total number 18 responses were received making this the final sample size. More detail on sampling and sample size will be discussed in this chapter in the next section.

3.3.1.3 Step 3: Analysing and interpreting the information

The field visits for data collection were between November 2023 to February 2024 using pre-designed open (semi-structured) and closed-ended (structured) questionnaires. Data were collected through questionnaires with open-ended and close-ended questions. A pilot study was conducted in four facilities that did not form part of the actual final study. Similar questionnaires

were used in all facilities to make the study reliable. Permission was sought from the heads of departments before issuing the questionnaires to the participants. The language of communication was English or the local dialect where this was preferred.

The collected data was analyzed by using International Business Management Statistical Package for Social Sciences version 24.0. The captured data was converted to Microsoft Excel 2013 and descriptive statistics were used to analyses frequencies and cross-tabulate variables to gain a better understanding of the data. Thematic analysis was also used, based on the formulation of the questionnaires which was based on the requirements outlined by the legal and policy framework on HCRW management.

3.3.1.4 Sharing the results with the participants

This final step of the Action Spiral Research Process concerns the sharing of the results of the research with the participants that took part in the questionnaire. Lune and Berg (2017:140) states that sharing the results of the research with the participants will encourage working as a collective among the participants in order to bring about change to the issues identified. This dissertation will be made electronically available on the Selinus university webpage for the participants to access at any given time.

3.4 Sampling

Researchers normally have strict time frames to complete their researches so in order for the research to meet those timeframes, the researcher will need to do sampling of the population that they want to base the research on, to meet strict time frames, reduce margin of error and manage limited resources available. Sampling is taking a subset from a chosen population or entire population used to make an inference about the chosen population or to make generalization in relation to the existing theory (Taherdoost, 2016). According to Taherdoost (2016), sampling can be divided into two types: probability/random and non-probability/non-random sampling (Figure 1 6). Probability sampling refers to every item in the sample having

an equal chance of being selected in the sample since the sample is selected randomly using a computer program. One of its advantages is that it is free from bias, however it has a high level of sampling error (Zikmund, 2002). Yen (2003) stated that non-probability sampling focuses on small samples and it intends to examine real life phenomenon and not to make statistical inference in relation to the wider population.

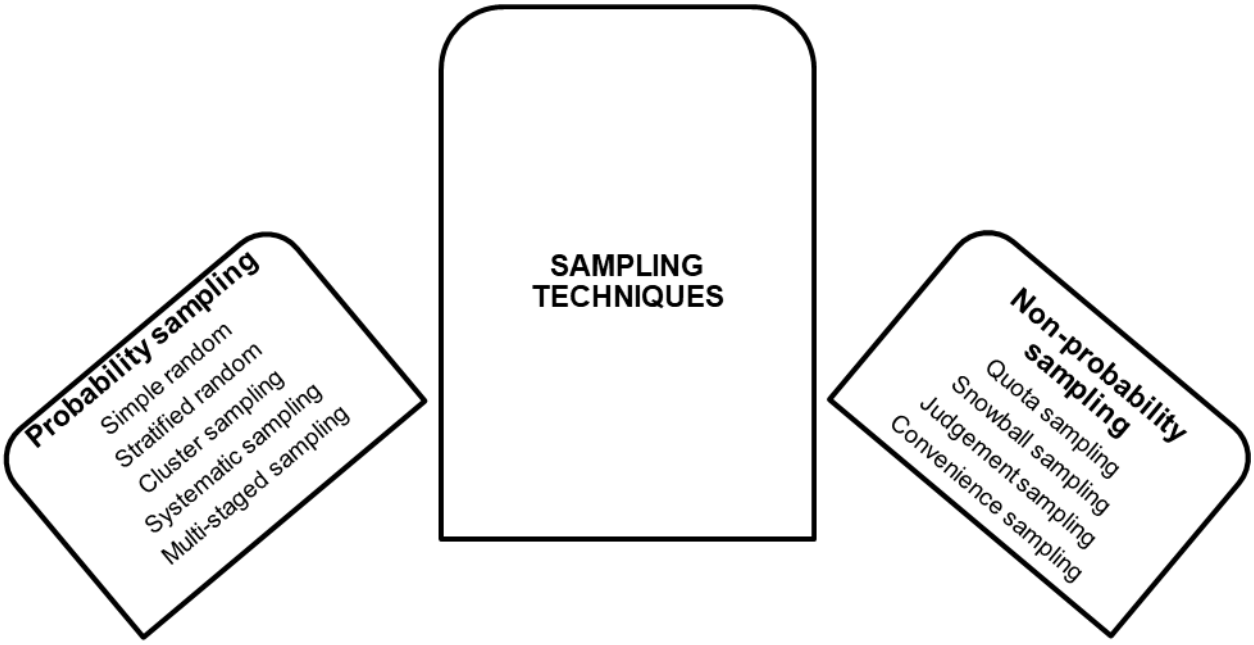

Figure 1 6 Sampling Techniques (Taherdoost, 2016:16).

This research study used a purposeful snowball sampling technique in order to answer the research questions. Purposeful sampling is defined by Patton (2014:2) as "selecting information rich cases to study, cases that by their own nature and substance will illuminate the inquiry question being investigated". Purposeful sampling was selected because of its benefit of effective use of limited resources and home-base care givers are a small community. Snowball sampling was chosen because it is most applicable in small populations that are difficult to access due to their closed nature like secret societies and inaccessible professions (Breweton and Willard, 2001). Home-based care giving practice is an inaccessible profession because it does not have a regulatory body. Even though snowball sampling is time-consuming, it has an advantage to estimate rare characteristics (Briks and Malhotra, 2006). According to Taherdoost

(2016) and Gill *et al*. (2010) an adequate sample size should be surveyed in order to reduce sampling errors and bias. Sandelowski (1995) recommends that researchers use small sample sizes in 'deep, case-oriented analysis' and in 'new and rich textured understanding' large sample sizes are used. For this research study questionnaires were sent to 50 participants with knowledge and experience in medical waste management. Even though the target was to get response from approximately 15 participants, at the end 18 participants responded making this the final sample size. Based on the feedback received, the feedback showed the redundancy signals as discussed in step 2 of the Action Research Spiral Process, and based on the redundancy signals the researcher was convinced that the data saturation has been reached.

3.5 Ethical considerations

This study employed different ways to ensure that the ethics of research are followed. Firstly, the research ensured that the participants remained anonymous. Secondly, participants were informed about the purpose of the study and that they were given an opportunity not to participate if they did not want to, hence participation was voluntary. The study was conducted based on secondary data from literature reviewed, evaluation of adherence to best practice and supported by interviews in the form of questionnaires, with limited human interaction. The study involved human participants, but did not include any sensitive respondents like children, elderly and persons with disabilities. Informed consent was obtained from all respondents for their voluntary participation, and they were treated with respect and dignity. No harm took place during the study, and the rights of the respondents were respected. Anonymity was ensured as respondents' details and particulars of premises were not recorded by the researcher or anywhere in the questionnaires. The study received ethical clearance from Selinus University of Sciences and Literature.

3.6 Methodological limitations

The main limitation of this research study was the availability of literature on home medical waste management. Since this topic of home medical waste management is not well-researched, it was difficult to compare the findings of this research study with that of the previous authors

to provide context. The other limitation of this research study was the inability to conduct face to face interview due to the sensitivity of the study. The researcher notes that respondents are more likely to rush through the self-administered questionnaires than during face-to-face interviews where there is an opportunity for the researcher to ask follow-up questions.

3.7 Chapter Summary

The objective of this chapter was to highlight the importance of choosing an appropriate research methodology for this research in order to meet the research objectives. This chapter discussed the different types of research methodologies, discussed a detailed literature review on the chosen research methodology, thus the qualitative research methodology. In this chapter, reasons were provided for the research methodology chosen in this study and this was validated by its advantages. The chapter discussed the Action Spiral Research Process and discussed how the researcher linked this research process to the research study. In this chapter the different types of sampling techniques, how to eliminate the errors in sampling and how the population was sampled was also discussed. This chapter also discussed the importance of data sampling and when to cease data collection based on data saturation literature. The chapter also discussed the computer programs used in data analysis and how the program will be used to analyse the data collected. Detailed data analysis and discussions will be presented in Chapter 4.

CHAPTER 4

4.1 Introduction

The previous chapter discussed the type of research methodology this research study followed and motivated why qualitative research was chosen. Chapter 4 presents the feedback from the home-based care givers. The objective of this chapter is to analyse the research findings in order to answer Research Objective as mentioned in chapter 1 which is to critically review the household hazardous waste management in South Africa understand the effectiveness of waste management from the perspectives of South African home based care givers. The feedback received from the home-based care givers for Section A will be presented per question followed by a summary of findings with integration of literature from Chapter 2. The feedback received from the home-based care givers for Section B will be according to the themes that emerged from their responses as shown in Table 3-1 in Chapter 3. The final section of this chapter summarises the findings of this research.

4.2 Research findings

As mentioned in Chapter 3, the questionnaire consisted of two sections. Section A focused on the background of the home-based care givers, where they demonstrated their highest level of education; their years of work experience in home-based care; the sector where they gained their home-based care experience and lastly, the level of formal training they received in HCG. The responses to the questionnaires will be coded to adhere to the ethical requirements of this study and therefore participants will be referred to as PTP1–PTP18. The first section of the questionnaire (Section A) will be presented first. This section consisted of four close-ended questions (Questions A1 - A4). Questions A1 and A4 consisted of semi-closed questions of multiple choice with an option for participants selecting ‘other’ so that they can elaborate more on their choice. Questions A2 and A3 consisted of close-ended questions of multiple choice.

4.2.1 Section A: Participants Background

At the first question of the five under Section A (Question A1) participants were asked to indicate their highest level of education (Figure 1 7). Here, seven (7 of 18) participants demonstrated that they held an auxillary certificate qualification, whereas nine (9 of 18) held a Grade 12/Matric certificate and two (2 of 18) indicated that they had "Other" qualification which they elaborated further that it is a Grade 10 progress report.

Only one participant responded that they have "E. Other". In response hereto, participant (PTP4) elaborated that: *"They never reached grade 12/matric due to the financial situation at home that compelled them to go look for a job and support their siblings since all their parents have since passed on."*

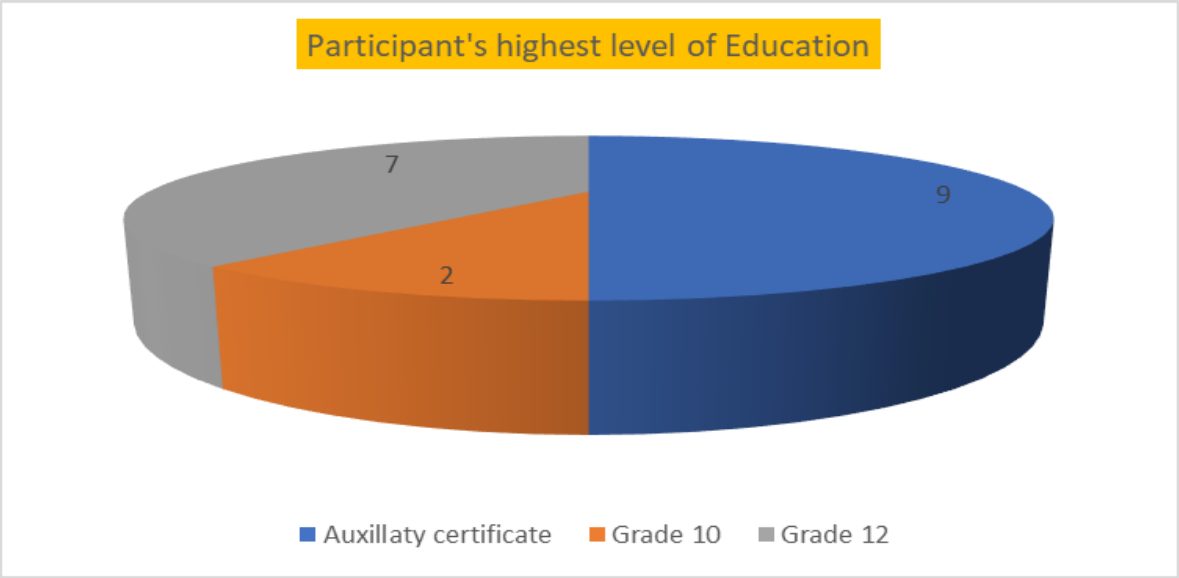

Figure 1 7 Participant's highest level of education (Question A1)

Question A2 questioned participants on the number of works experience they have in home-based care and the results are shown in Figure 1 8 below. Of the 18 participants, only one participant - PTP 10 indicated that they have more a years' experience of between 11-15 years; 3 participants indicated that they had more than 15 years' experience while 1-5 years and 6-10 years shared the spoils of seven participants each.

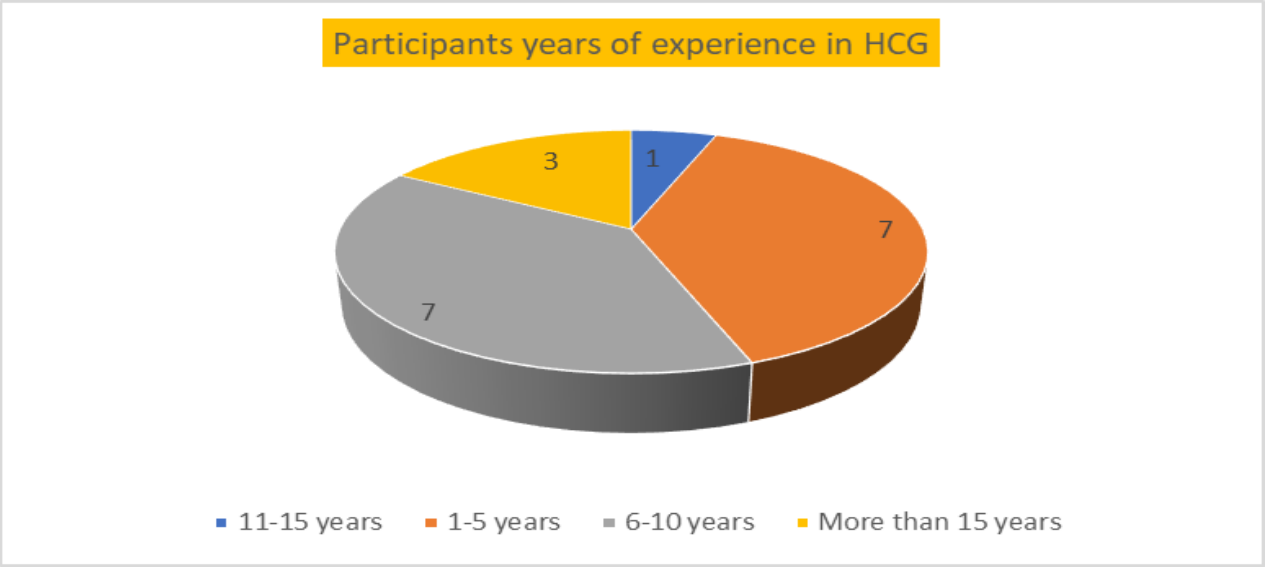

Figure 1 8 Participant's years of experience in HCG

Figure 1 9 below shows the participants response to question A3 where they gained their HCG experience and one out of 18 (1 of 18) participants, PTP 9 further added that *"they self-taught themselves from when they were talking care of their sickly mother and after the mother passed on, they then went out to seek for a job since they have identified this gap"* and they said they have gained their experience from both sectors, the private and the public sector while the 17 participants indicated that they only gained their experience out of the public sector.

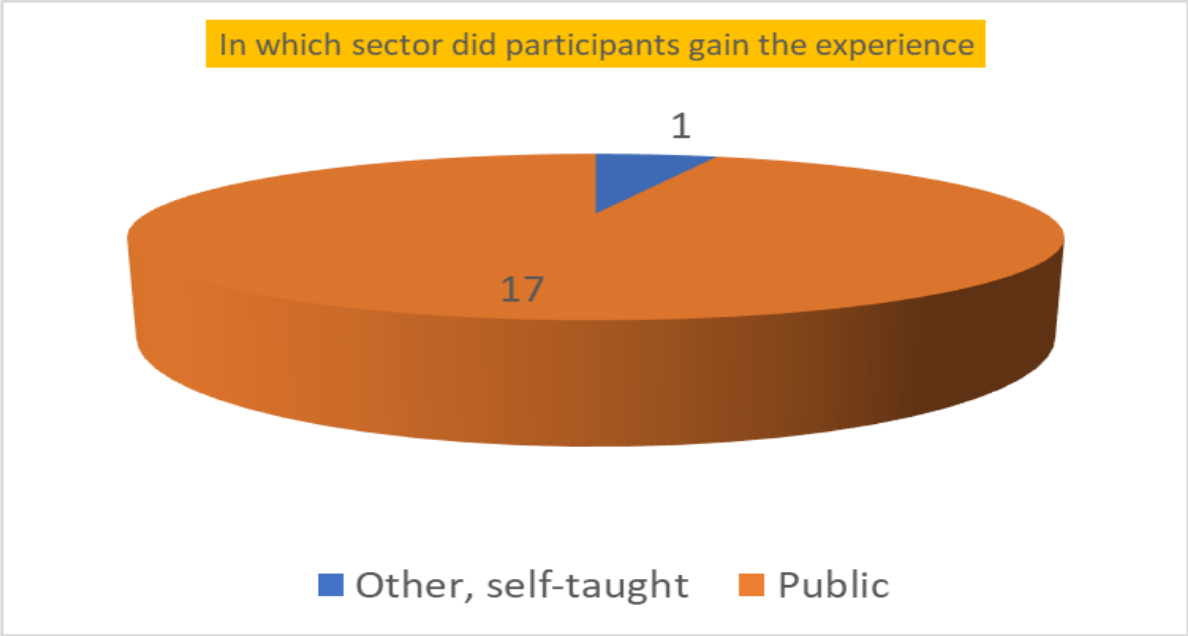

Figure 1 9 Sector when HCG experience was gained

The last about participant's background, Question A4 asked the participants about the extent of waste management training received and the results indicated by Figure 1 10 below that each participant has received some sort of training in home-based care giving indicating that the employer, either in private and/or public took time to equip these participants with the know how to execute their tasks.

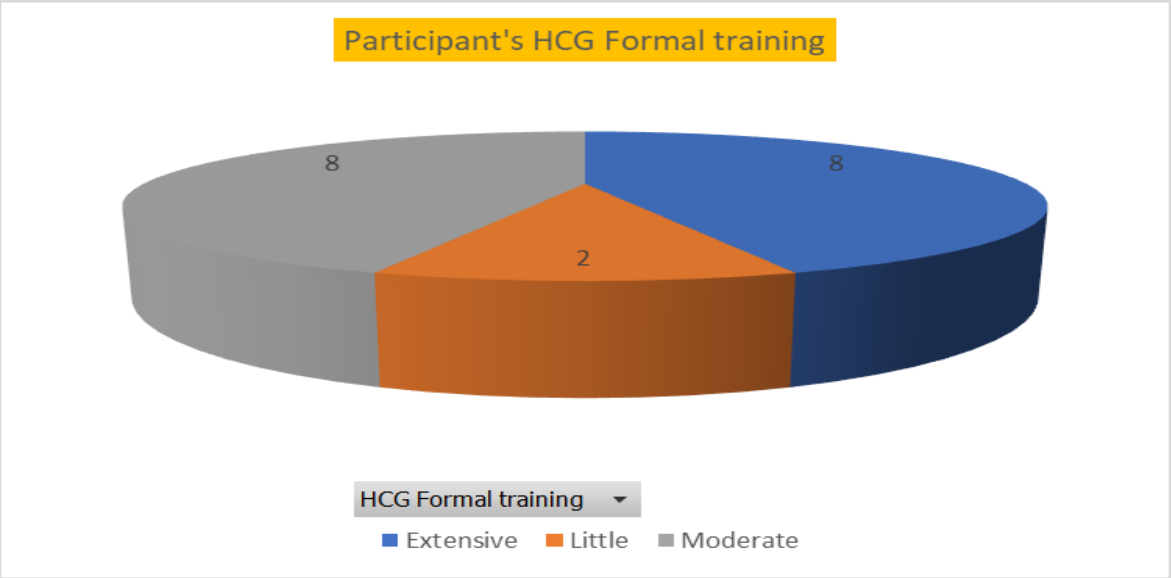

Figure 1 10 HCG Formal training received

The feedback received from the questionnaire about the participants' background, based on the participants' years of experience and the training received on home-based care giving, it can be concluded that these group of participants are knowledgeable in the HCG filed.

4.2.2 Section B: Waste management effectiveness assessment

This section consisted of both open-ended questions and semi-closed question to allow participants to elaborate further where necessary (see Annexure A). The section focussed on the waste management training; if the waste management training is an important tool to have during HCG; assessed if the HCG waste management training is achieving what is set out to achieve; what are the shortcomings of the HCG waste management training and what can be done to improve its shortcomings. Three themes emerged from the participants responses i.e. (1) HCG Waste management training goal, (2) HCG Waste management effectiveness, (3) HCG waste management improvement. Table 4-1 below shows the keywords that emerged from the actual data that was received from the participants that formed part of the theme's discussions.

Table 18-1: Key phrases/words from the participants' responses

Themes	Contributing questions to the themes
Theme 1: HCG Waste management training goal	"*…training is adequate however in practical, the training is not implemented; Training is different from field work…"*
Theme 2: HCG Waste management effectiveness	"*…there needs to be penalties for not doing it the right way; lack of resources to collect the waste; lack of accountability; lack of will…"*
Theme 3: HCG waste management improvement	*"…increase awareness; intensify waste management training; increased accountability; implement the regulations; ongoing monitoring; registration body…"*

4.2.2.1 Theme 1: HCG Training goal

To answer the first objective of this research which is: "To understand the fundamental purpose and objectives of HCG waste management training", the following questions were grouped together: Questions B1, B2 and B3. The first question that contributed to this theme was Question B1, where the participants were firstly asked if they received the waste management training and all of them answered that yes. All 18 participants have been trained on waste management.

Participants were further probed on the importance of waste management training based on their experience and the majority of the participants (17 of 18) "*Strongly agree"* that waste management training is an assessment tool, while only one participant (PTP2) "*slightly disagree"* that waste management is an important tool to have.

The last question that formed this theme is question B3, where participants were asked according to their perspective, what is the goal of HCG waste management training and do they think it is achieving what it is set out to achieve? The feedback indicated that there is a common understanding among participants of what the goal of waste management is. The participants stated that the purpose of waste management training is to "improve their knowledge regarding disposal of medical waste and to minimise the risks associated with improper waste management" (PTP2), "*to classify, segregate correctly and dispose safely*" (PTP3), and *"to identify and manage the waste impacts, mitigate risks using the waste mitigation hierarchy*" (PTP4). However, the 14 out of the 18 participants say they are not convinced that waste management training is achieving its goal: PTP1 stated that "*waste training is achieving what its purpose is from a document execution viewpoint and lacks during implementation*"; according to PTP4 *"waste training has a potential to go a long way if it gets the commitment from the higher powers"* meaning if the government can commit and allocate funds to it, it can achieve its goal. knowledgeable personnel with good intentions"; and PTP11 also added that *"the training has an enormous potential if it can be implemented correctly".* Further in response hereto PTP6 and PTP9 concurs with PTP4 that for waste management training to achieve its goal, "*if all stakeholders/authorities can play a key role [be considered] in planning and the design of programs and developments, it should achieve what it set out to do*". However, PTP5 and PTP8 disagrees with PTP4, PTP6 and PTP9 and said that it is achieving its own goal currently.

4.2.2.1 Theme 2 HCG Waste management effectiveness

Question B5 questioned participants on what are the most important shortcomings in waste management that might be an obstacle towards its effective management, based on their experience. Responses from the participants on this question demonstrated that they know what a best practice of waste management, however the feedback on this question had different perspectives and there was no coherence because the responses were based on the participant's experiences. PTP1 is of the opinion that due to *"lack of legislation to comply to".* PTP2 said that some of the shortcomings of waste management are that it is sometimes medical waste training is used as a *"tick box"* exercise for companies to complete their compliant process. PTP4 concurred with PTP 2 on waste medical training being used as a *"tick box"* exercise and

PTP4 added that this means that "medical waste training to staff is sometimes just done as a form of compliance and not necessarily a passion and concern for the people in the respective context that drives the process". PTP5 said from their experience, the fact that home-based care givers are not departing from their hospital/clinics offices makes it difficult for them to take the waste generated during their home visits for safe disposal since they don't have waste containers and means of transport. According to PTP6 and PTP8, *"the lack of resources like funds"* and that is what is rendering waste management to be ineffective.

"The difficulty in accessing the homes of the patients due to bad roads, political unrest…" were the factors that led to an ineffective waste management based on the experiences of PTP4 and PTP8. PTP1, PTP11 and PTP13 mentioned that "lack of continuous awareness and lack of a regulatory body" for the home-based care givers were the main cause of an ineffective waste management for them, while PTP10, PTP13 and PTP14 shared the same experience when they all said "*lack of will by the government*", and for PTP15 and PTP18 it was *"due to government's failures to streamline their processes"*. However, PTP9 is of the opinion that the waste management process is not managed correctly due to "corruption." PTP9 elaborated that if government knows how medical waste is supposed to be disposed then why are they ensuring that it is done correctly.

4.2.2.3 Theme 3: HCG Waste management improvement

The last theme (Theme 3) that emerged from the participants' feedback on Question B6, i.e., what can be done to improve the effectiveness of HCG waste management in SA, is included here. The participants had similar opinions on what need to be done to improve HCG waste management practice in South Africa. In their responses they demonstrated what improvements can be made to improve the effectiveness of HCG waste management in SA. PTP4 is of the view that "*introducing waste reporting and audits*" will assist to improve the management, while PTP2, PTP6, PTP7, PTP13 and PTP15 are of the opinion that government need to develop guidelines and monitor compliance after training. PTP13 and PTP15 added that following

training, home-based care givers should be transported and collected from the private homes of their patients so that they can be able to take the waste generated during the visits back to their clinics/hospitals. should also "register with a registration [regulatory] body" and PTP 7, PTP15 and PTP18 concurs that a regulatory body will "…. *increased accountability, ongoing monitoring*…" However, PTP17 concurs with PTP 6, PTP7, PTP13 and PTP15 and elaborated further that in order for HCG waste management to improve, there need to be a "*continuous awareness*", and that we need to "eradicate corruption in South Africa…" (PTP16).

4.3 Summary of findings

This section will use a thematic analysis, interpretation of research findings and literature reviewed in Chapter 2. The questionnaire started off with assessing the background information of the participants and from the received feedback it can be seen that the participants are highly experienced and with high number of years' experience in the field makes their feedback and input valuable for this research. The feedback received from the participants on educational level shows and supports the point raised in Chapter 2 that there is no formal competency training required for someone to be a home-based care giver indicating that this can be conducted by just anyone.

4.3.1 Theme 1:

None of the care givers that participated in the study had a nursing/care giving degree. At least 9 half of the participants (9/18) had an auxiliary certificate which is regarded as a basic course in nursing. The qualification serves to provide learners with the basic knowledge, affective, cognitive and conceptual tools and practical techniques for additional higher education studies in nursing. The knowledge emphasizes general principles and their application in the provision of basic nursing care. This qualification signifies that the learner has attained a basic level of higher education knowledge and competence in nursing and is capable of applying such knowledge and competence in the workplace.

4.3.2 Theme 2:

The interview response on training indicates that the care givers are trained on medical waste management and the response was that the generated waste that was left in the homestead was included with domestic waste. It was stored in domestic waste containers or plastic bags for a week. The houses are not equipped with waste storage facilities or areas therefore waste is stored outside the homes. The health care risk waste left in the household is either stored in plastic bags or general waste containers for approximately one week. The waste is then collected by municipal waste truck to be disposed of in domestic waste landfill site. The interview response on the health care risk waste management practices, the handling, storage, and disposal practices by care givers was that the care givers use different methods to dispose of the generated health care risk waste. The care givers chose the only method for disposing of the health care risk waste.

4.3.3 Theme 3:

Recommendations for efficient and effective health care risk waste management practices by home-based care givers. The care givers gave recommendations to improve the working procedures and conditions of care givers. A health care risk waste management plan after an intense consultative process with all relevant stakeholders is required. The recommended plan needs to be detailed, explaining how the generated health care risk waste will be classified and separated at source from the domestic waste. It first needs to describe the activities of care givers that generate health care risk waste. Thereafter, explain how the generated health care risk waste will be quantified and effectively managed, including handling, storing, and disposal. It has to specify the roles and responsibilities of the all the stakeholders in the proper management of health care risk waste and accountability and punitive measures to be taken against mismanagement of health care risk waste.

4.4 DISCUSSIONS

It is without a doubt that there is health care risk waste generated in homes and quantities is rapidly increasing and it is a global issue. There needs to great emphasis placed on the management of this waste. This is because mismanagement of this waste is linked to numerous high health and environmental threats. It is also a violation of environmental and health laws. The health and environmental impact that mismanagement of health care risk waste may be identified, however the impact is far devastating than what is revealed. Therefore, management of home generated health care risk waste should be a priority. Delivering and improving health care risk waste management services for home generated health care risk waste may seem as an additional financial burden for the government. Nevertheless, the real economic, environmental, and health costs of mismanagement of health care risk waste cannot be quantifiable.

The consequences of inadequate management of health care risk waste generated in homes are not limited to patients, their relatives, and health care workers but affects waste workers, scavengers, and the unsuspecting public. It contributes to the morbidity, mortality, and decreased in life expectancy especially for the poor and the vulnerable groups. It also contributes to environmental pollution and degradation. Services provided by caregivers, as stated above, are nursing care, physical care, patient support, domestic chores, and psychological care. Nursing care includes dressing wounds, administering medication, and supervised treatment support (directly observed treatment support).

Physical care includes assisting patients to use toilets, feeding and bathing patients, changing patients, and helping patients exercise. Domestic chores include collecting water for patients, and cleaning and washing for patients. The psychological care includes health education, counseling, rehabilitation, and praying. Support includes referring patients to health care facilities, identifying people who do not have any source of income, and bereavement counseling. The services that mostly generate health care risk waste are nursing care and physical care. As physical care includes bathing patients, and assisting them to go to the toilet, the water used may be contaminated. The contamination may be either body secretions or blood resulting in the used water being health care risk waste. The materials used during nursing care

such as bandages, cotton wool and gauze are often contaminated with human secretions such as pus and blood. Nappies used by bedridden patients, and cotton wool and bandages used for treating wounds contain human secretions and are health care risk waste. Discarded medication containers are also health care risk waste.

Results show that management of health care risk waste was not getting the attention it deserves because it was competing with other issues of home-based care for the very limited available resources. The health care risk waste was managed at the discretion of the generator, not according to legislation. The appropriate practice is to take the generated health care risk waste to the nearest health care facility where the waste will enter the correct stream and be managed according to the regulations of the country. However, this practice faces financial and resource challenges as there is a growing number of people that require the services of care givers. The care givers are therefore left with the responsibility of managing the health care risk waste on their own. The majority of the generated waste enters the general waste stream. It was either disposed of by the local authority or thrown away at the discretion of the home owner. This indicates lack of capacity by the Department of Health in dealing with health care risk waste and great negligence, as the waste was still handled and disposed of

Discussions with the supervisors of the care givers revealed that home-based caregivers sometime also provide counseling to patients and members of the family with sick people. However, counseling does not generate health care risk. People with terminal illnesses needed to be counseled so that they can cope with the disease. It is also done to assist family members to cope with living with a terminally ill person and with a death in the family. Furthermore, home-based caregivers conducted health education that is very broad and incorporates numerous health issues. The most common health issues, though, were HIV/AIDS and TB, and education was given both on prevention and protection. The approach of the South African government to HIV/AIDS is prevention through health education, therefore education is the key vehicle used to curb the scourge. The home-based caregivers were also used to conduct health education on the importance of the use of drugs such as antiretroviral therapy and TB drugs on HIV/AIDS in general. They were also used to conduct education on mother to child HIV/AIDS transmission, and breast feeding.

Home-based caregivers are used to reduce the patient medication defaulter rate through health education by ensuring that patients take their medication as required by the Department of Health. There is a very high medication defaulter rate, especially among TB patients and home-based caregivers play a significant role in ensuring through health education that the patient adheres to the treatment plan. Assisting patients to take their medication generates health care risk waste because the containers where medication is kept are health care risk waste. Health education is also conducted to prevent and control other communicable diseases.

4.5 Chapter Summary

As mentioned in Chapter 3, the questionnaire was sent out to home-based care givers in South Africa to get their perspective on the effectiveness of the medical waste management training and to identify the areas of improvement and where more attention is required. Feedback was received from 18 HCGs, referred as participants in this research and from the participants' feedback, three themes emerged. The emerged themes were, education level of each HCG; effectiveness of the medical waste training and lastly, medical waste management improvement. The general feedback from the participants indicates that they know what the goal of the medical waste training is, and acknowledge that medical waste generated in homes in South Africa has its own flaws but if the flaws can be corrected, the level of medical waste management effectiveness will improve. Participants also indicated that medical waste training is an important tool; if conducted and implemented correctly, it can be an effective tool in sustainable development. Participants are recommending that there should be a formal medical waste training; reporting; audits and monitoring for anyone that generate medical waste at home, there should be a regulatory body that ensure HCGs are registered and monitored to ensure compliance. The next chapter will conclude this research with the key findings from this research, conclusions and recommendations of this study.

CHAPTER 5

5.1 Introduction

The previous chapter provided the responses to the questionnaire and linked the feedback to the literature reviewed in Chapter 2. This concluding chapter will give a brief discussion of the previous chapters and concluding reflections of the previous chapters. This chapter will also discuss the limitations encountered while conducting this research and discuss the key findings as addressed and presented in Chapter 4. The recommendations for implementation derived from this research findings will be presented, and lastly the summary of suggestions for future studies will be given.

The World Health Organization (WHO) describe medical waste, also known as health care waste (HCW) as any by-products that is generated in the diagnosis; treatment and/or immunization of people or animals, in research pertaining to, or testing of biological, including but not limited to blood soiled instruments and bandages, cultures dishes, surgical gloves, needles, lancets; swabs, instruments and removed body parts or organs (Chartier *et al*., 2014).The available literature shows that there is less focus on management of waste generated at homes; no formal training for home-based care givers, lack of national waste management policy to abide by and there is no regulatory body for home-based care givers in South Africa. The research aim of this study will be discussed and summarized in the next section.

5.2 Recommendations

Recommendations for efficient and effective health care risk waste management practices by home-based care givers. The study offers a list of recommendations made to improve the working

procedures and conditions of care givers. A health care risk waste management plan after an intense consultative process with all relevant stakeholders is required. The recommended plan needs to be detailed, explaining how the generated health care risk waste will be classified and separated at source from the domestic waste. It first needs to describe the activities of care givers that generate health care risk waste. Thereafter, explain how the generated health care

risk waste will be quantified and effectively managed, including handling, storing, and disposal. It has to specify the roles and responsibilities of the all the stakeholders in the proper management of health care risk waste and accountability and punitive measures to be taken against mismanagement of health care risk waste.

5.2.1. Monitoring of the Generated Health Care Risk Waste

The South African government has focused monitoring and control of health care risk waste generated in health care facilities and less to no monitoring from the care givers. Results from the research indicate that the generated health care risk waste by home-based care givers enters the general waste stream. The main reasons for this practice are traceable to ignorance and unavailability of resources to handle the generated health care risk waste adequately. The work of care givers needs to be monitored closely to identify activities that generate health care risk waste. This can assist with the monitoring of waste produced by care givers. The monitoring will help with resource allocation and will further support the generation of prevention and protection measures of the public and the environment.

5.2.2. Resource Allocation

Management of health care risk waste by home-based care givers needs to be allocated financial and human resources. Suitably qualified people should be employed so that they can ensure that waste generated by care givers is managed effectively. The type of storing of health care risk waste separately from domestic waste suggested by the 2005 WHO guidelines require appropriate resources (WHO, 2005). It is important to examine programs to sponsor the collection of household medical waste, according to the "polluter pays" principle, as done in many countries around the world. Producers, importers, distributers and pharmacies, in addition to the government, should take a part in sponsoring the collection, transfer and treatment of household medical waste. A cost/benefit analysis should be done, considering the financial costs involved in disposing drugs, and the outer costs (environmental damage, investments in advanced purification systems etc.)

5.2.3. Development of Policies and Guidelines

South Africa has regulations governing medical waste management, such as the National Environmental Management: Waste Act (No. 59 of 2008). However, the implementation at the household level remains a challenge. There are no legislation/guidelines regarding the collection and the treatment of household medical waste. There is a need for laws and regulations for handling this issue in South Africa regarding several aspects:

(a) laws that will enable collection of household medical waste by institutes like collection by pharmacies, collection drop boxes in the police, at hospitals, in the post offices and even in big supermarkets. Additionally, enacting laws to allow organization to hold drug collection events, similar to the collection events held in the US, or collection of household medical waste from people's homes.

(b) Individuals who pass away at homes leave medications that are usually thrown to the garbage. It is important to establish a mechanism to collect and transfer the non-expired medications to needy populations and the expired ones to destruction.

(c) It is worthy to examine laws for incentives for returning medications to local doctor; clinic; hospitals or private pharmacies, such as getting pay-back money or other rewards.

(d) Similarly, to Europe, it is advisable to promote regulations and procedures regarding special instructions and precautions for disposal that will appear on the outer packaging of medicinal product, in the patient information leaflet or on the medication label.

(e) Laws that will regulate the funding of programs for collection and destruction of medications, preferably following the “polluter pays” principle, by which, pharmaceutical companies will pay for the collection, shipment and destruction of household medical waste.

Significant health and environmental catastrophes may be experienced if current health care risk waste management continue. The irreversible damage caused by improper management of health care risk waste has already been done especially to the environment. It can, however, be stopped from getting worse. The policies should stipulate the correct procedures for health care risk waste management so that everyone may have common and standard health care risk waste

management procedures. They should also include the manner in which management practices will be monitored and evaluated and invoke consequences for failure to comply.

5.2.4. Government and Departmental Collaboration and Cooperation

Government departments should work in a cooperative and transparent manner with one another in order to have a good working relationship primarily on issues of health care risk waste. The government departments must work together to promote the health of care givers, waste workers, and the community by ensuring that they do not get injured by the generated health care risk waste. They should also prevent environmental degradation and pollution by ensuring that the environment is protected from the generated health care risk waste. The household medical waste problem is relevant to several governmental ministries, especially the Ministry of Health (protecting the public health), and Ministry of Environmental Protection (waste collection is under the responsibility of this ministry, and also the environmental implication of household medical waste). Cooperation between these ministries is needed in order to promote this important field.

All departments within the health sector are essential in health care risk waste management. However, the agencies that may play a critical role are the environmental health practitioners, waste management experts, and infection control practitioners. These departments have insights into the current challenges resulting from the mismanagement of health care risk waste. They can also assist with community education, and offer adequate support for the care givers in proper health care risk waste management.

5.2.5. Training of Home-Based Care Givers

Training on health care risk waste should be offered to all care givers, patients and the community at large, however such training should be mandatory. Different platforms such as public meetings and gatherings can be used to educate the public. Over and above being trained, the community must always be reminded of health care risk waste management issues. The following media can be used to remind the public: aggressive marketing on billboards and

transport systems, radio and television advertisements, handing out pamphlets and fliers, doing campaigns, etc. Training will ensure that both the care givers and the community have an in-depth understanding of the implication of health care risk waste mismanagement on the health of the people and the environment.

5.2.6. Community Education / Awareness

It seems that one of the major problems in this field in South Africa is the public's lack of awareness regarding the health and environmental implications of medication accumulation and disposal. It is therefore important to raise the public's awareness to this issue. Ongoing education of the community on health care risk waste management and the impact of mismanagement health care risk waste on human health and the environment is important. Aspects of health care risk waste must not be the responsibility of the care givers only, but the patients receiving nursing services from care givers should take the same amount of ownership, if not more. The community as a whole should also take full responsibility because they will also be affected by the mismanagement of health care risk waste. Awareness raising tools, including publishing relevant data in the government websites or in social medias platforms, publicity projects, campaigns, and brochures, may be relatively easy and fast to perform within the Ministry of health without the need to collaborate or coordinate with other external entities. It is important to raise physicians' awareness to this issue, and emphasize the importance of avoiding prescription of unnecessary medications or excessive amounts of medications. In addition, it is important that pharmacists supply detailed information regarding disposal of unused/expired medications. Community engagement and education initiatives are vital for raising awareness and promoting behavior change regarding medical waste management in home-based care settings. Mavura *et al.*, (2023) evaluated the impact of community-based educational programs and found improvements in knowledge and practices among caregivers. As South Africa continues to address the challenges of medical waste management in home-based care, a concerted effort involving stakeholders at various levels is necessary to ensure compliance with regulations, promote sustainable practices, and safeguard public health and the environment.

5.2.7. Assessment and Auditing

Assessments and auditing of health care risk waste generated by home-based care givers should be carried out to carry it out regularly. Assessment and auditing would be important for the verification of the quantities of health care risk waste generated and disposal of the generated health care risk waste by the care givers. The reports from assessments and auditing will enable the management to assess their capacity to manage the health care risk waste appropriately. This would prevent the current situation of health care risk waste generated by care givers being unaccounted for.

5.3. Recommendations for Further Research

There has been very little research conducted on health care risk waste in developing countries, and the available research is inadequate. In South Africa there is an insufficient information regarding home-generated health care risk waste, especially health care risk waste generated as a result of home-based care activities. There is therefore a need for further research on home generated health care risk waste. This may result in proper planning and resource allocation for health care risk waste management so as to protect the health of individuals and the environment.

There is also a need for further research on the impact that health care risk waste generated by home-based care givers has on waste employees that collect and dispose of domestic waste, waste handlers that recycle the waste, and waste scavengers. There is also a need for further research on the accurate impact that health care risk waste generated in homes has had on the health of people and animals that may be exposed to the waste and the environment.

5.4 CONCLUSIONS

The study was conducted in urban or metropolitan area and the findings shows that there is non-compliance to the way waste is managed so one can wonder if there is non-compliant is urbanized areas how is the situation in the rural areas of developing countries like South Africa. The rural areas that have improper/limited infrastructure; informal domestic waste management and lack of awareness. The majority of households in the rural areas do not have basic sanitation facilities such as toilets, running water and waste removal services, aggravating the issue of health care risk waste mismanagement.

If urban areas are not compliant with proper medical waste management practices, it can have significant implications for rural regions. Here is a summary of the status and potential harm:

1.Environmental contamination: Improper disposal of medical waste in urban areas can lead to environmental contamination through the spread of pathogens, toxic substances, and hazardous chemicals, impacting rural ecosystems and water sources.

2. Health risks: Inadequate medical waste management in urban areas can result in the spread of diseases and infections, which can potentially affect rural populations through contaminated water sources, vectors, or air pollution.

3. Community health impact: Non-compliance in urban areas can have indirect health impacts on rural communities, especially if contaminated waste is not properly contained and managed, leading to increased risks of infections and illnesses.

4. Cross-contamination: Improper handling and disposal of medical waste in urban areas can facilitate the spread of pathogens and contaminants to rural regions, posing risks to both human health and the environment.

To mitigate these risks, it is essential to improve medical waste management practices in both urban and rural areas, promote awareness about proper disposal methods, strengthen waste collection services, and establish regulations and enforcement mechanisms to ensure compliance with safe waste management practices across all settings. Collaboration between urban and rural authorities, healthcare facilities, communities, and relevant stakeholders is

crucial to address the challenges of medical waste management effectively and protect public health and the environment in developing countries like South Africa.

The study found that the current South African Health Care System, especially because of the quadruple burden of diseases, are inadequate to manage the health needs of the people. And yet the services provided by the home-based caregivers will continue to be a necessity in the near future. As mentioned, caregivers play a significant role in improving the lives of people and promoting their health. It is only appropriate that their working procedures be re-evaluated and changed so that they do not harm the environment and people's health. As revealed in this study, a considerable amount of health care risk waste generated by caregivers is managed in a manner that endangers the environment and the lives of all those exposed to the waste. Findings of this study show that the health care risk waste management of home-based caregivers is not practiced in accordance with best practices as approved by the Department of Health.

The offered recommendations by the study are to improve the working procedures and conditions of caregivers to protect health, preserve the environment, and comply with the law. Suggested recommendations include: having a health care risk waste management plan, monitoring the generated health care risk waste, resource allocation, development of policies and guidelines, government and departmental collaboration and cooperation, community education, training of caregivers on health care risk waste, and continuous assessment and auditing. However, the most important suggestion is the need for further research that will shed light on the areas of focus and the best way for dealing with the management of health care risk waste.

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ANNEXURES A – QUESTIONNAIRE

Institution: Selinus University

Field of Study: PhD in Environmental Management

Full dissertation title: Medical waste management: Study of household practices and potential harm in the developing countries like South Africa.

Student Name: Ms. Nare Matlakala

Student number: UNISE2209IT

Email Address: zebora01@gmail.com

Contact number: +2782 722 8265

Dear Home-based care giver,

My name is Nare Matlakala. I am a post-graduate PhD student engaged in the study of the abovementioned topic at the Selinus University, Rome campus via distance learning. This research forms part of my PhD studies in Environmental Management. The aim of my study is to understand how medical waste generated in the households are managed.

The purpose of the study is two-fold:

- To understand if home-based care givers are trained on medical waste management; and

- To understand if the training given is effective in the management of the medical waste generated in their line of duty of home base care giving.

You are invited to participate because of your expertise in the relevant field of household medical waste management**.** This research will be conducted by a structured questionnaire which consist of 11 closed- and open-ended questions, respectively. The interview process will take about 30 – 45 minutes to complete. Participation will be on a voluntary basis and you are free to withdraw from the questionnaire at any time. There are no risks in this study as all results

will be presented anonymously for confidentiality purposes. Kindly return your completed questionnaire to zebora01@gmail.com by 16th of February 2024.

Thank you in advance for your participation in this study and your contribution to the field of Household medical waste management research.

Kind Regards,

Ms. Nare Matlakala

QUESTIONNAIRE ON MEDICAL WASTE MANAGEMENT OF THE WASTE GENERATED DURING HOME-BASED CARE.

Instructions:

- Please use **X** to indicate your selection.
- Kindly elaborate in your answers where necessary.

SECTION A: BACKGROUND OF THE HOME-BASED CARE GIVER

A1. What is your highest level of qualification?

A. Grade 12	B. Auxiliary certificate	C. Nursing Degree	D. Other

Kindly elaborate on your field of study. If your answer is “D. Other”, kindly elaborate on your qualification details as well:

A2. How many years of working experience do you have in Home-based care giver (HCG)?

A. 1-5 years	B. 6-10 years	C. 11-15 years	D. More than 15 years

A3. In which sector/s did you gain your experience in conducting HCG? Select more than one where applicable.

A. Private Hospital	B. Public Hospital	C. Other

If your answer is “C. Other”, kindly provide the name/s of sector/s:

A4. How much formal assessment/training do you have in HCG?

A. Extensive	B. Moderate	C. Little	D. None

SECTION B: WASTE MANAGEMENT

B1. Did you receive medical waste management training?

A. Yes	B. No	C. Something like that

B2. From your experience, do you think medical waste management training is important?

A. Strongly agree	B. Slightly agree	C. Slightly disagree	D. Strongly disagree

Kindly elaborate on the reason for your answer:

B3. From your perspective, what is the goal of HCG waste management training and do you think it is achieving what it is set out to achieve?

B4. How do you dispose of the medical waste that was generated during each visit?

A. In the domestic bin	B. Take it back to the clinic

B5. From your experience, what are the most important shortcomings in waste management that might be an obstacle towards its effective management?

B6. From your perspective, what can be done to improve medical waste management in South Africa?

------END----