



University of Venda

**School of Environmental Sciences**

**Department of Ecology and Resource Management**

**Compliance Level with Current Health Care Risk Waste Management Regulation in  
Thulamela Local Municipality Health Care Establishments, South Africa**

**by**

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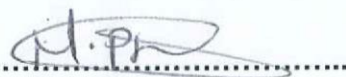
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## Declaration

I, **Nematenda Pfunzo Priscilla**, declare that this research entitled "Compliance level with current health care risk waste management regulation in Thulamela Local Municipality Health care establishments, South Africa" submitted to the Department of Ecology and Resource Management, School of Environmental Sciences at the University of Venda, is my own work, it has never been submitted before for any degree for examination at any university and all reference material contained therein has been duly acknowledged.



11 / 07 / 2020

Student's Signature

Date

Ms. P.P Nematenda

We, the Supervisors, certify that this declaration is correct

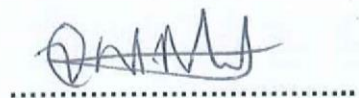
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11 / 08 / 2020

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## **Dedication**

This dissertation is dedicated to the Limpopo Department of Health, Limpopo Department of Economic Development, Environmental and Tourism who gave me permission to conduct this study. It is also dedicated to the Department of Ecology and Resource Management, School of Environmental Sciences at the University of Venda and to my family and friends.

## Acknowledgements

Firstly, and most importantly I would like to thank God who have been with me since the beginning, giving me strength to complete this study. I highly appreciate and give sincere thanks to my supervisor, Prof. J.S. Ogola and my co-supervisor Dr. N.V. Mudau, and for their dedication, for unlimited guidance and expertise that enabled me to complete this study in record time. Prof. P. Bikam I would also like to thank you for being there and willing to help me in the last minutes. I also extend my earnest gratitude to the Department of Ecology and Resource Management, School of Environmental Sciences at the University of Venda.

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## Abstract

Non-compliance with Health Care Risks Waste (HCRW) management regulation continues to be a major challenge all over the world. Improper management of HCRW has potential negative impacts on human health and the environment. This study was conducted to assess the level of compliance with HCRW management regulation in health care establishments at Thulamela Local Municipality, Vhembe District. The study adopted a mixed method which consists of qualitative and quantitative research approaches. The three hospitals and 15 clinics were purposively sampled from public health care establishments in the Municipality. The 15 clinics were selected using simple random sampling. Qualitative data was collected using semi-structured interviews to gather in-depth information from the participants, and observation checklist was used during fieldwork. Semi-structured questionnaires were adopted in gathering quantitative data from 167 respondents in the selected health care establishments. Qualitative data was analyzed through Atlas.ti version 8.4 for citations, and quantitative data was analyzed with the Statistical Packages for the Social Sciences (SPSS) version 25.

Findings of the study revealed that 77.8% of the 18 health care establishments had health care waste management plan, but the remaining health care establishments did not have management plan, which is an indication of non-compliance with the regulation. The study revealed that types of HCRW generated in the study included: sharps and vials; infectious; anatomical/pathological; pharmaceutical and chemical; as well as radioactive waste. They are the same types of HCRW generated in establishments globally. Sharps and infectious wastes are the most generated sub-categories of HCRW. The daily practice of operational workers on health care waste management and handling shows lack of knowledge and non-compliance with the regulation. Most of the health care establishments do not have proper temporary storage room that meet regulation standards. This is the main challenge that shows the lowest level of compliance, whereas the highest compliance level is on keeping the records of the type and amount of HCRW generated. To improve the level of compliance with the regulation and reduce the negative impact of poorly managed health care waste on the environment and human health, this study recommends that all health care workers should be regularly trained on health care waste management. It further recommends continuous monitoring of compliance with health care waste regulations and policies at all times at the health care establishments.

**Keywords:** Compliance, Health Care Risks Waste, Management, Regulation, Establishment.

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## List of acronyms

HCW	Health Care Waste
HCRW	Health Care Risk Waste
HCWM	Health Care Waste Management
WHO	World Health Organization
IPWM	Integrated Pollution and Waste Management
DWAF	Department of Water Affairs and Forestry
DEAT	Department of Environmental Affairs and Tourism
DEA	Department of Environmental Affairs
UNEP	United Nations Environmental Program
AIDS	Acquired Immune Deficiency Syndrome
HIV	Human Immunodeficiency Virus
WMT	Waste Management Theory
GPS	Global Positioning System
SPSS	Statistical Packages for the Social Sciences
SANS	South African National Standards
WHO	World Health Organization

## CHAPTER 1 : INTRODUCTION

### 1.1 Background

According to the World Health Organization (WHO, 2018), of the total amount of wastes generated by health care activities, approximately 85% are general or non-hazardous waste which are similar to domestic waste, and the remaining 15% is considered hazardous material that may be chemical, radioactive or infectious. Morales (2013) defined Health Care Risks Waste (HCRW) as a by-product of health care activities (diagnosis, preventive, curative and palliative treatments for human beings and production or testing of biologicals) produced at any health care establishment including: sharps, non-sharps, body parts, blood, chemicals, radioactive, and pharmaceuticals waste. In terms of the WHO Fact sheet, the United Nations (UN) Basel Convention considers HCRW as the second most dangerous waste after nuclear waste (WHO, 2016).

It is unquestionable that HCRW impacts adversely on human health, environment and society at large if inappropriately managed (Hossain *et al.*, 2011). In addition, the illegal dumping of hazardous waste causes a danger, not only to the scavengers' health who are exposed directly to it, but also to the environment when pollutants move around into sources of water and ultimately cause widespread toxicity and infection (Du Toit and Bodenstern, 2014).

Measures to ensure a safe and environmentally sound HCRW management can prevent adverse impacts on the environmental and human health, impacts which include the unintended release of biological or chemical hazards, and drug-resistant microorganisms, into the environment thus, protecting the health of workers, health patients, and the community (WHO, 2018). Therefore, managers and medical officers are expected to take more responsibility and comply with available legislative frameworks to ensure safe management of such waste (WHO, 2014). HCRW requires special handling, treatment and disposal and this is usually governed by specific legislation, regulations, and guidelines to ensure that waste is properly managed and environmentally achievable standards are met (Lee *et al.*, 2002).

HCRW is highly regulated by well-developed legislative frameworks worldwide (Jansen *et al.*, 2017). In South Africa, Section 24 of the Constitution of the Republic of South Africa (108 of 1996), provides that "everyone has a right to an environment that is not detrimental to human health or well-being; and to have environment protected for the benefit of present and future

generation through reasonable legislative and other measures. In this regard, the Constitution imposes a duty on the State to promulgate legislation and to implement policies to ensure that this right is upheld.

In pursuant of the constitution, to date, several steps have been taken to ensure this environmental right. According to DEAT (2000), the steps undertaken involved the Environmental Management Policy for South Africa (1998) publication, the publication of the Draft White Paper on Integrated Pollution and Waste Management (IPWM) (Government Gazette Notice: 1686 of 1998), the promulgation of the National Water Act (NWA) (Act 36 of 1998), National Environmental Management Act (NEMA) (Act 107 of 1998), and the development of a National Waste Management Strategy (NWMS) (1999). The Waste Management Series (Version 2), known as the Minimum Requirements, was developed in 1998 by the Department of Water Affairs and Forestry (DWAFF) (DEAT, 2000). The IPWM process lead to the development of the National Waste Management Strategy for South Africa in 1999. The Regulation relating to health care waste management in health establishments, which is Regulation number 375, of 23 May 2014, under National Health Act (No. 61 of 2003), Environmental Health Norms and Standards (2015) and Vhembe District Municipal Health By-laws (2012), govern the safe handling and disposal of HCRW and stipulates penalties for law transgressors.

This study therefore seeks to establish the level of compliance with current management regulation among health care operational workers in health care establishments in Thulamela municipality. The study tries to identify the gaps and challenges facing the health care operational workers and come up with recommendations for improving the level of compliance in managing HCRW. An improved level of compliance with HCRW management regulation will help in proper management of HCRW and consequently reduce the risk associated with improper management to the environment and to human health.

## **1.2 Study area**

Below shows the location of the study area and the climate in which the areas in situated.

### **1.2.1 Location**

Thulamela Local Municipality is one of the four local municipalities of Vhembe district, in Limpopo Province, South Africa (Fig.1.1). It has a Global Positioning System (GPS) coordinates of

approximately Latitude:  $-22^{\circ}56'44.30''S$  and Longitude:  $30^{\circ}29'5.89''E$ . The Levubu river forms most of the southern border while the eastern part of the Soutpansberg mountain range forms most of the northern border of the Thulamela Local Municipality. Collins Chabane Municipality forms the boundary in the east while sharing the border with Musina Municipality in the northeast and Makhado Municipality in the southwest.

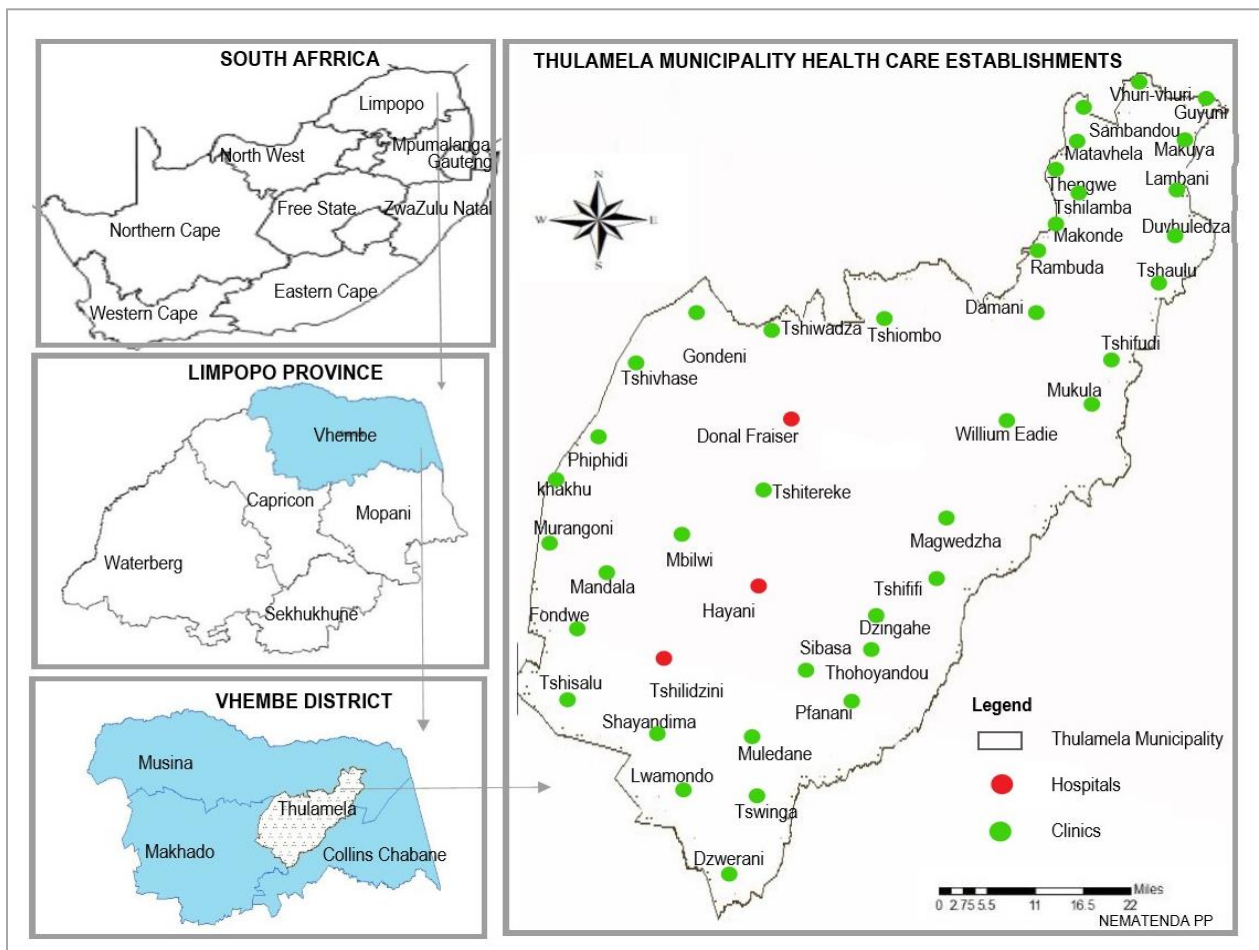


Figure 1-1: Location map of the study area

Source: Derived from ArcGIS, Thulamela Local Municipality (2019)

In terms of population, it is the largest of all the municipalities falling under Limpopo Province. According to Census of 2011, the population of Thulamela municipality was 618, 462 (Thulamela Integrated Development Plan Review, 2016/17).

### 1.2.2 Climate

The Thulamela climate is typically moist winters and wet, and warm summers characterized by low veld. It receives approximately 500 mm annual rainfall, of which about 87.1% falls between October and March, in summer (Poto and Mashela, 2008). The rainfall pattern is mainly influenced by the orographic rain effect of the Drakensberg mountains joining the Soutpansberg perpendicularly hence decreases from east to west of the district (Thulamela Integrated Development Plan Review, 2016/17). During winter periods, from May to August, climate is warm during the day with dry air dominant and less than 20 mm of rainfall is usually, with the average rainfall dropping to 8mm during August (Mpandeli, 2014)

### 1.3 Problem statement

The management of HCRW from health care establishments in many countries falls short of the minimum standard required by the HCRW management regulation (WHO, 2009). Non-compliance with HCRW management regulation continues to be a major challenge which leads to mismanagement of HCRW all over the world (De Titto *et al.*, 2012). In South Africa despite having legislations in place such as the National Health Act (No. 61 of 2003), indications of non-compliance persist. The regulation relating to health care waste management in health establishments (R. No. 375, of 23 May 2014) specifies that no health establishment may manage health care waste other than in accordance with this regulation and the national norms and standards however this has not been the case. The report by the Green Scorpions find out that noncompliance is due to lack of understanding and training with regards to the safe and legal disposal of HCRW by most companies and service providers in South Africa (Sampson and Mkhize, 2017).

In South Africa, although legislations are in place, those who are tasked with proper management of HCRW most often do not follow correct procedures and guidelines on issues related to segregation, categorisation, collection, transport, treatment and final disposal practices (Jewaskiewitz, 2013). A study conducted by Olaniyi *et al.* (2018) in Limpopo province noted that health care establishments are unable to manage their medical waste effectively due to lack of resources, lack of transparency in administration and management of available resources. Jansen *et al.* (2017) also agree that HCRW is highly regulated in several countries by well-developed legislative frameworks, however, there is lack of effective and compliance to laws and directives in developing countries like South Africa. Moreover.

Some previous studies conducted in Limpopo health care establishments focused only on Health Care Risk Waste Management (HCRWM) and documented poor management (Nemathaga *et al.*, 2008; Motlatla, 2015). However, none of those studies were found to have paid special attention to a major cause of poor HCRW management which is the level of compliance with the existing Regulation. The study conducted by Netshifhefhe (2017) in Thulamela Municipality hospitals also documented poor HCRW management because of mixing general and health care risk waste; shortage of health care waste containers which lead to improper disposal and shortage of protective clothing. Poor management of HCRW as a result of non-compliance with legislations is a problem that requires further investigation.

#### **1.4 Justification**

Yawson (2014) reported that because of non-compliance with HCRW management regulations, there is an improper handling of HCRW which is also due to the lack of waste management department; insufficient and non-use of personal protective equipment (PPE) as well as lack of knowledge and training for waste generators and handlers. Improper management of HCRW is the challenge to most health care establishments, as this has an impact on both the natural environment, the community as well as that health working in health care establishments (Goddu *et al.*, 2007).

It was therefore essential to conduct this study as it determined the level of compliance with HCRW management regulation in health care establishments. In Thulamela Local Municipality this study has provided required information concerning HCRW management in health care establishments operational workers, help the government and local authorities in enforcing compliance with the existing HCRW management regulation and planning measures to mitigate the impacts of ineffective HCRW management practices. This will help to provide a safe environment for the community.

#### **1.5 Research questions**

- What are the types of Health Care Risk Waste (HCRW) generated?
- What is the level of knowledge of administrators and operational workers (doctors, nurses and cleaners) involved on HCRW management in health care establishments?
- What is the level of compliance with HCRW management regulation in health care establishments?

- What are the challenges faced by administrators and operational workers in the health care establishments on HCRW management and the level compliance with the regulation?

## 1.6 Objectives

The main objective of the study was to assess the level of compliance with the current Health Care Risk Waste (HCRW) management regulation in health care establishments in Thulamela Local Municipality.

The specific objectives were to:

- Identify the types of Health Care Risk Waste (HCRW) generated in the health care establishments;
- Evaluate the level of knowledge of administrators and operational workers on HCRW management (segregation and labeling, storage, collection, transportation and disposal);
- Determine if health care establishments administrators and operational workers comply with the regulation regarding HCRW management; and
- Identify challenges faced by administrators and operational workers in the health care establishments on HCRWM and compliance with the regulation.

## 1.7 Definition of key terms

**The Act:** refers to the National Health Act, 2003 (Act No. 61 of 2003)

**Regulation:** refers to the regulation relating to health care waste management in health establishments (R. No. 375, of 23 May 2014).

**Health care establishment:** is any public-sector or private sector institution, facility, building or place where health service users receive treatment, diagnostic or therapeutic interventions or other health services (Department of Health, 2000).

**Waste:** is any unwanted or discarded substance that the generator has no further use of for the purposes of production, if that substance can be reduced, re-used, recycled or recovered (Michael-Agwuoke, 2012).



**Environment:** is a complex of many variables that surround man as well as the living organisms, including water, air, land and their interrelationships (Kalavathy, 2004).

**Health care waste:** is defined as the total waste stream from health care and includes health care risk waste and health care general waste (WHO, 2005).

**Health care risk waste:** is a by-product of health care activities produced at any health care establishment including: sharps, non-sharps, body parts, blood, chemicals, radioactive, and pharmaceuticals waste (Morales, 2013).

**Health care general waste:** is non-hazardous waste from the health establishments mainly generated during the administrative and housekeeping functions of the health care establishment as well as from patients and visitors (Pruss *et al.*, 1999).

**Compliance:** is the state of being in accordance with established guidelines.

**Waste management:** is the process of collecting, transporting, recovery, treating and disposal of waste that is discarded because it is no longer useful (DEA, 2012).

**Health care operational worker:** any individuals who are responsible and engaged in the protection or improvement of people's health (Makhura, 2016). In this study health care, operational workers are referring to operational workers such as doctors, nurses, health care waste cleaners.

**Health care waste cleaner:** in this study health care waste cleaner is described as an individual who is responsible for cleaning in the wards and collecting HCRW from the ward to the temporary storage.

**Health care administrators:** in this study, they are referring to the manager or individuals responsible for the whole establishment.

**Semi-structured interview:** data collection instrument with pre-determined closed-ended and open-ended questions which allow further questioning, reasoning, interpretations and give more freedom of discussion in order to understand the subject (Kudoma, 2013)

**Semi-structured questionnaire:** it is a reliable data collection instrument consisting of a series of both closed-ended and open-ended questions that allows respondents to give their views anonymously (Abawi, 2013).

## **Chapter Summary**

This chapter gives a background on the assessment level of compliance with current Health Care Risk Waste (HCRW) management regulation in Limpopo, South Africa. It gives an idea that in Limpopo there is limited studies conducted on compliance with available legislations in South Africa, which also show the importance of conducting this study and help to provide the safe environment for people. The chapter also outlined that there is a problem of improper management of HCRW all over the world which is as a result of compliance with available legislations and regulations. It also provided a synopsis of the formulated research questions, objectives and expected outcomes which guided the researcher to develop a broadly research methodology. The next chapter provides the literature review of the study

## CHAPTER 2 : LITERATURE REVIEW

### Introduction

Waste has been the main environmental problem in the world ever since the industrial revolution that if it is improperly dealt with, it also poses a threat to human health. Michael- Agwuoke (2012) defines waste as any unwanted or discarded substance that the generator has no further use of for the purposes of production, if that substance can be reduced, re-used, recycled or recovered. and the environment. According to Nkhabu (2018) waste management is a basic human need and can be regarded as a basic human right, as ensuring proper sanitation and waste management sit alongside the provision of clean air, water, energy, food, shelter, transport and communications as important to society and to the whole economy. In the absence of waste regulation compliance and their difficult enforcement and implementation, a waste generator will tend to choose the cheapest available course of action.

There are many different types of waste, but the study focuses on Health Care Risk Waste (HCRW) as is regulated in few countries by well-developed legislative frameworks; however, there is a lack of adherence and development to laws and directives in developing countries such as South Africa. Although legislation is in place, it does not always address HCRW in detail for assisting with problems such as segregation, collection, transport, treatment and final disposal practices. The study will be guided by the National Health Act (Act No. 61 of 2003), regulation relating to health care waste management in health establishments (R. No. 375, of 23 May 2014) as it states that there should be compliance, enforcement and monitoring of the regulation at health establishment. Literature review in this study will cover the following: theoretical framework, classification of health care waste, sources of HCRW, HCRW treatment disposal, risks associated with non-compliance with HCRW management regulation, HCRW management, legislation for HCRW management and challenging or causes of improper management of HCRW.

### 2.1 Theoretical framework

The theoretical framework is one of the essential aspects in the research process as it serves as a guide that build, support the structure, and gives an emphasis on the context of the study. of a study. It consists of the selected theory or theories that undergirds individual's understanding and planning of research work, including concepts and definitions relevant to the study (Grant

and Osanloo, 2016). This study was guided by Theory of Planned Behavior and Waste Management Theory (WMT).

### **2.1.1 Theory of Planned Behavior (TPB)**

This theory started as the Theory of Reasoned Action in 1980 for prediction of one's intention to engage into behavior at a specific place and time. In 1985 Ajzen proposed The Theory of Planned Behavior (TPB) and has been used for prediction of one's behavior and to understand its causes (Armitage and Christian, 2003). It suggests that a behavior of a person is highly determined by one's intention. Nevertheless, this theory had some limitations as behavior is not solely determined by intention where an individual's control over the behavior is incomplete. Therefore, Ajzen introduced the TPB with addition of a new concept, "perceived behavioral control" which comprises of the internal and external resources that affect behavior either indirectly or directly through intentions (Ajzen, 1985; and Wise et al., 2006).

The TPB has been positively used in different fields including waste management with an emphasis on the health and environmental related behavior. For example, behavior of proper health care waste management process from segregation into color-coded bins revealed that health care workers keeping more favorable attitude with a greater perceived behavioral control tended to have stronger intention in engaging in proper waste handling or management behavior. The TPB was found to be a useful theory in predicting health care workers' health care waste management (from segregation of health care waste generated to the final treatment and disposal) behaviors (Akulume and Kiwanuka, 2016). The TPB significantly predict health care worker management behavior through strengthening their 'perceived behavioral control and intentions can be effective in improving health care workers' management of health care waste as well as compliance with the regulation.

### **2.1.2 Waste Management Theory (WMT)**

Waste Management Theory (WMT) is an integrated body of knowledge about waste and waste management, founded on the expectation that waste management is to prevent waste to cause harm to human health and the environment. It is an effort to establish various variables of the waste management system. Abstract conceptualization, as a cognitive process, has helped humans to obtain knowledge in all areas; to group and classify it, and to provide it with suitable structure. Creating and expanding individual sciences and meta-sciences have resulted (Hubka and Eder, 1988).

Waste Management Theory is considered within the model of Industrial Ecology and built side-by-side and in relation with other relevant theories, most particularly Design Theory. Design Theory is a relatively new discipline, still under development. Following its development, it offers valuable insights about evolving technical theories. According to Love (2002), it is crucial to theory development to integrate theories from other bodies of knowledge, as well as the clarification of the definition of core concepts, and mapping out key issues, such as domains, epistemologies and ontologies. At the present stage of the development of WMT, epistemologically well-bounded definitions of key concepts have been offered, and the connection of WMT to neighbor theories as well as to the paradigm of Industrial Ecology is being studied. Ontological commitments have been adapted by way of choosing the theory language of WMT.

It is important that every health care establishment takes immediate steps to reduce the environmental and health harm that results from waste management practices. Solution to proper HCRW management lies in the appropriate training of the health care workers to proper segregation of such waste. It is also important for municipal corporations to making stringent laws and ensuring that there is compliance by both the health care workers. Health care can protect public health by reducing the volume and toxicity of the wastes they produce, and by implementing a range of environmentally sound waste management and disposal options.

## **2.2 Classification of health care waste**

World Health Organization (WHO, 2014) classified health care waste into health care general waste (non-hazardous) and health care risk waste (hazardous). The regulation relating to health care waste management in health establishments (R. No. 375, of 23 May 2014), defined HCRW as waste capable of producing any disease and it is sub-classified into various categories which include sharps, infectious, pathological, cytotoxic, pharmaceutical, chemical, and radioactive waste (Table 2.1). It was also confirmed by previous studies that those types of HCRW are generated in almost all health care establishments in Africa (Motlatla, 2015; Kudoma, 2013; Vumase, 2009 and Nemathaga, 2008).

Table 2-1: Types of Health Care Risk Waste

HCRW Types	Description
<b>Sharp</b>	Sharp wastes are waste that include needles, surgical scissors, disposable syringes, knives, surgical blades, infusion sets, broken glass vials and scalpels
Infectious	Wastes that contain pathogens and materials that have are contacted with infected patients or excreta, it also includes liquid waste such as blood, feces, and urine.
<b>Pharmaceutical</b>	Expired pharmaceutical products, contaminated pharmaceutical products, surplus and unused drugs.
<b>Radioactive</b>	Waste containing radioactive substances such as used and unused liquids from radiotherapy and laboratory research and contaminated glassware.
<b>Genotoxic</b>	Waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs; genotoxic chemicals
<b>Pathological/ Anatomical</b>	Human tissues, organs, body and blood fluids, body parts, foetus, unused blood products.
<b>Chemical</b>	Wastes with chemicals such as laboratory chemicals, disinfectants, heavy metals waste and film developer.

Source: Author edited from WHO (2014).

### 2.3 Sources of health care risk waste

According to Rappe and Nyregen (2009), large quantities of HCRW are generated daily from various sources; most hazardous and poisonous HCRW come from health care establishments. Only a small quantity is from domestic or industrial sources. Nemathaga *et al.* (2008) and Hossain *et al.* (2011) added that industrialized countries generate higher amounts of HCRW than non-industrialized countries. World Health Organization (WHO, 2018) classified HCRW sources into major and minor source depending on the quantities generated. Major sources are health care establishments that include hospitals, health care centers, emergency medical care services, maternity and community clinics, laboratories, research centers and first aid posts. Minor sources include pharmacies, convalescent nursing homes, psychiatric hospitals, mortuaries, disabled persons' institutions and physicians' office.

Cheng and Yuanan (2010) established that the amount of HCRW generated from health care establishment is associated with institution's size or type and an increase in patients' number and services results in an increase in HCRW. According to the Regulation No. 375 of May 2014 on National Health Act No. 61 of 2003, all health establishments that generate health care waste have a duty to dispose of the waste in a safely manner; they are legally and financially responsible for the safe handling; and environment sound disposal of the waste they generate; they must always assume that the waste is hazardous until shown to be safe; and have a responsibility of the waste management from the point of generation to its final treatment and disposal.

## **2.4 Health care risk waste management**

### **2.4.1 Health care risk waste management plan**

According to Regulation No. 375 of May 2014 on National Health Act No. 61 of 2003 under health care waste management plans (Chapter 3), each major health care waste generator should have a health care waste management plan in place. It also stated that health care waste management should include monthly generation rate of HCRW, and general waste recorded. Chapter 4 of the regulation also specifies that the owner or person in charge of the health care establishment should establish a health care waste management team or committee. Motlatla (2015) pointed out that the health care waste management plan helps with the development of norms and standards for employee's health and safety. Health care waste management planning is considered functional only if the management team has been recognized (Motlatla, 2015).

According to the regulation the management plan should have management committee should have staff members such as: the chief executive officer or facility manager; the appointed health care waste officer; a representative of the section responsible for cleaning and hygiene services; the representative of the section responsible for procurement; an infection and prevention control officer; a quality control officer; an occupational health and safety officer; environmental health practitioner of the area; and a nominated health and safety representative, and all should do their work.

### **2.4.2 Health care risk waste management process**

Chapter 5 on the requirements applicable for health establishment emphasized that the person in charge of health establishment shall make sure that HCRW is handled, collected, transported,

removed, treated and disposed of in a manner as not to pose a risk or danger to human health and the environment.

According to Chartier *et al.* (2014) planning for health care waste management at all establishments should consider the World Health Organization's (WHO) core principles to achieve safe and sustainable management of health care waste. Therefore, it is a health care management responsibility to ensure that there is an appropriate and practicable HCRW management. According to Crick (2012), waste management process includes very important key stages that include segregation, collection, storage, handling, transportation, treatment and disposal and an additional of educational training as indicated in Fig.2.1 below.

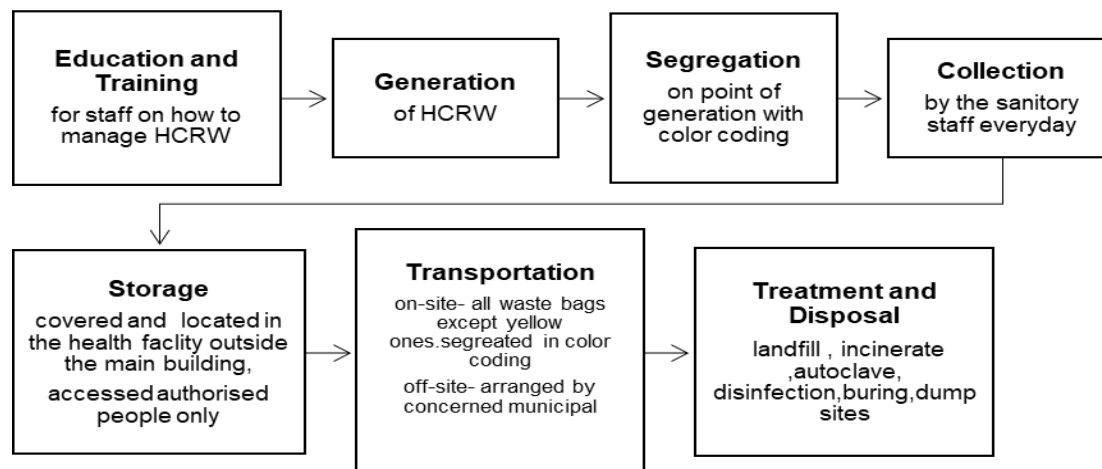


Figure 2-1: Health Care Risk Waste management process

Source: Researcher's own construct

#### 2.4.2.1 Training and awareness

To ensure a good HCRW management, there should be proper training carried out with health care establishment employees for the development of awareness on the health, safety and environmental issues (Kumari *et al.*, 2012). All staff members should be trained on waste management, handling, segregation, storage, disposal and treatment procedures. Individual involved in handling HCRW should be provided with protective equipment as well as receiving proficiency certificate after successful completion of appropriate training (Dawar, 2017). The Constitution of the Republic of South Africa stated that everyone has a right to an environment that is not harmful to their health and well-being, and the safe disposal of hazardous waste is



also governed by legislation in South Africa. However, reports of the illegal disposal of waste propose that there is still a lack of general knowledge and training on the safe disposal of health care waste (Du Toit and Bodenstein, 2014 and Motlatla, 2015).

#### **2.4.2.2 Segregation**

According Khobragade (2018), segregation refers to separation of HCW into selected different categories. The Regulation stated that to a minimise contamination risk to the environment and people's health, all health care waste should be segregated at their point of generation and should be containerized. It is the responsibility of waste generators such as doctors and nurses to segregate HCRW from the point of generation for appropriate route of safe disposal, which also enables those who handle waste containers outside the wards to identify and treat such waste appropriately (Kudoma, 2013; and Zikhathile and Atagana, 2018).

According to the regulation (R.375 of May 2014) and Dawar (2017), health care waste should be segregated with different colour coding, where black is for non-risk or general waste, red for infectious or risk waste without sharps, yellow for risk with sharps, green for chemical and pharmaceutical waste. In many countries in African, hazardous waste are still handled and disposed together with general waste, thus creates a great health risk to health care workers, the community and the environment (Hangulu, 2018). The regulation (R.375, May 2014) also specifies that to improve proper management of health care waste, all health care operational workers should be trained of health care waste segregation and minimization, and records of all training should be kept.

Kumar *et al.* (2015) stated that lack of discrete HCRW bins for separating infectious from non-infectious waste lead to inadequate workers' safety. It is the responsibility of the HCRW generators such as doctors, nurses, technicians and paramedical personnel to separate waste. Failing to segregate the different health care waste according to the risk they pose leads to complex stream of waste, which is very problematic to manage which also results in all types of waste being disposed together.

#### **2.4.2.3 Containerization**

To encourage segregation of HCW at source, waste containers with liners should be placed as close as possible to the point of generation, with proper colour-coding and specific symbols marked on them, for example yellow or red container for infectious waste with clearly marked

international infectious waste symbol (Khobragade, 2018). Colour-coding of HCRW containers in terms of identifying the type of waste, as well as the source of generation, plays an essential role in the health care waste management. Kumar *et al.* (2015) pointed out that the shortage of health care waste containers or poor containerization have an impact on the safety of health care workers, so containerization should be considered an important aspect of health care waste management process.

#### **2.4.2.4 Handling**

According to Olaniyi *et al.* (2019) safe handling of HCRW occurs at all stages from the point of generation until the point of treatment and disposal. Dawar (2017) stated that operational workers who handle waste should use Personal Protection Equipment (PPE) during health care waste collection, and they should be aware of the high health risk of HCRW. Kumar *et al.* (2015) reported that the most significant issue to proper health care waste handling at their establishment is as a result of lack of compliance on the wearing and use of appropriate PPE by health care waste handlers. Therefore, all individuals or operational workers involved in waste handling are to handle it in an appropriate manner with caution keeping in mind the risks they pose to them, other people as well as on the environment.

#### **2.4.2.5 Storage**

According to Dawar (2017) the proper temporary storage is important for the safe storage of HCRW and to protect it from the access of unauthorised individuals and stray animals, which also minimize environmental pollution and health risks. The place where the health care institutions keep their waste before being transported to the final disposal sites is referred to as a temporary waste storage. The location and size of any waste storage is dependent on the quantity and type of health care waste generated and the frequency of waste collections (Kudoma, 2013). Regulation stated that the owner or person in charge of a health establishment should establish intermediate and central storage areas for health care risk waste storage which is easy to access, with lockable doors, size of the area should be determined by the rate of waste generated, though should be accessed only by personnel responsible for the handling, transportation, incineration and final disposal of the waste. Establishments should also be secured from domestic and wild animals, birds, rodents and insects by using a locked wire mesh cage. Time for storage should not exceed 48 hours, especially in countries that have a warm and humid climate (WHO, 2005).

#### 2.4.2.6 Collection and transportation

Abdulla *et al.* (2008) described that transportation of HCRW should always be controlled through a document representing at least the volume and waste type, where it was generated, when it will be collected from the temporary storage room as well as a place of destination. Kumari *et al.* (2012) added that transportation routes within a health care establishment must be specifically designated to avoid passage through patient care areas. According to Bio-medical Waste Management and Handling Rules (1998), waste should be transported according to the Motor Vehicle Act which proposes standards for hazardous wastes. In other words, the vehicle should have proper markings which show that infectious HCRW transportation. The Regulation No. 375 of May 2014 on National Health Act No. 61 of 2003 under Chapter 6 states that all HCRW to be transported should be packed and labeled in accordance with the provision in the South African National Standard 10229-1.

#### 2.4.2.7 Treatment and disposal

Waste treatment refers to the reduction of waste volume weight, risk of infectivity and organic compounds in the waste before it can be disposed (WHO, 2018). Disposal methods can be landfilling or composting and must be done in accordance with proposed policies and guidelines to prevent harm to the health care operational workers, waste handlers and pollution of the environment (WHO, 2016). According to the regulation health care waste treatment and disposal should follow the requirements as specified in the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), and the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) and any amendments thereof. The Regulation No. 375 of May 2014 on National Health Act No. 61 of 2003 states that all health establishments that generate waste have the duty to dispose of waste safely. Olaniyi *et al.* (2018) stated that there are different methods used in health care institutions to treat or dispose of infectious or non-infectious waste, which include the following methods:

- **Incineration** is considered as the golden treatment method nevertheless there is a trend towards its use for only the most difficult waste fraction (Blenkharn, 2011). Hasan (2018) defined incineration as a process of controlling combustion that reduces solid, liquid or gaseous waste mostly to carbon dioxide, non-combustible residue or ash and other gases. An incinerator that is properly designed and constructed should entirely burn the waste leaving at least number of

residuals in the form of ashes and it should be equipped with scrubber to trap poisonous air pollutants released (Nemathaga *et al.*, 2008).

- **Sterilizing** of HCRW is considered as an alternative method to incineration, although it is regarded as a costlier method when compared to incineration (Jang *et al.*, 2006; Al-Khatib and Sato, 2009). Nevertheless, sterilization is unable to treat chemicals as well as hazardous substances including waste from chemotherapy treatment, mercury, volatile and semi-volatile organic compounds, radioactive waste, and other hazardous chemical waste (Lee *et al.*, 2002). Sterilization is normally used to treat HCRW such as sharps (syringes, needles, scalpels, ampoules, broken glass), items contaminated with blood, remain from surgery as well as from separation wards, bandages and non-chemical laboratory waste.
- **Dumping** is a process of disposing of waste material in an open space far from living places without burring, it is regarded as the most popular health care waste disposal method in developing countries, possibly for the reason that it is less expensive, and there are no other alternative methods available at a costs that is reasonable (Al-Khatib and Sato, 2009).
- **Landfilling** is the deposition of waste in a specially designated area away from living place, which in modern sites consists of a pre-constructed cell lined with an impermeable layer and with controls to minimize emission (Narayana, 2009).

## 2.5 Agreements and conventions

In addition to the principles, there are also the current agreements and conventions relating to the waste management from health care establishments, protecting the environmental and development, identifying issues that need to be considered in the preparations of legislative and political waste management directives. These agreements and conventions include the Basel Convention, the Bamako Convention as well as the Stockholm Convention.

### 2.5.1 Basel Convention

The Basel convention include the controlling of trans-boundary movements of hazardous wastes and their disposal, it is the most popular and environmental treaty that is informational on hazardous and other wastes. This convention includes members from 170 countries, aiming on protecting the environment and human health from the adverse impacts resulting from the hazardous waste generated, managed, transboundary movements and disposal of such wastes.

This convention obliges parties and countries to greatly focus on the waste's importation and exportation and general overall lessening of waste generation. (Chartier *et al.*, 2014).

### **2.5.2 Bamako Convention**

Concentrating on the African regional area, and the exported and imported waste in Africa, this convention includes 12 nations who together negotiate in eliminating movement of hazardous waste in Africa. The convention was introduced in early 1991, and seven years after that came in force in 1998, it established as a result of criticism towards the Basel Convention, and its lack of prohibition towards hazardous wastes that moves into undeveloped countries. The Bamako Convention was established for creating more strict rules for ensuring the wellbeing of more undeveloped countries (Chartier *et al.*, 2014).

### **2.6.3. Stockholm Convention**

According to Chartier *et al.* (2014) Persistent Organic Pollutants (POPs) are the remaining of chemicals intact in the environment for extended period, becoming widely distributed geographically, accumulating in the fatty tissue of living organisms and are toxic to humans and wildlife. In some parts HCRW can be categorized as a POPs because of some of their hazardous qualities and from their incineration. This convention has impacts on the Finland's current situation with its incineration plants, due to the fact there are lack of incineration plants in Finland to create an expensive invest.

## **2.6 Environmental principles governing health care waste management**

There are five principles that are widely used by several countries in their legislative and political systems, these principles include polluter pay principle, precautionary principle, duty of care principle, proximity principle and prior informed consent principle (Chartier *et al.*, 2014).

### **2.6.1 The polluter pays principle**

This is a principle that imply to the basic rule that ensure that one who pollute should take responsibility of their own waste. Meaning that companies and individuals are legally and financially responsible for efficient and safe disposal of waste they produce. The This principle states that polluter must pay the remediation costs and it also tries to assign legal responsibility to the party that poses a damage (Schwartz, 2018).

### **2.6.2 The precautionary principle**

This principle pays attention in governing health and safety protection, taking after the principle 15, set by the Rio Declaration on Environment and Development (UNEP, 1972) “where there are threats of serious or irreversible damage to the environment, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (Chartier *et al.*, 2014).

### **2.6.3 The duty of care principle**

This principle entails that any entity that generates, collect, transports, treats, or disposes of waste should make sure that there is no unauthorized transfer of waste from its control until proper disposal is achieved. It connects the individual who handle and manage wastes, consequently creating the person’s ethical responsibility. Including working environment with educated and knowledgeable people in this area of business is considered to be the most efficient way to keep this principle functioning. All health care establishments must apply the duty of care principle to protect the environment and public health by taking full responsibility for the waste they generate (Pruss *et al.*, 1999).

### **2.6.4 The proximity principle**

This recommends that waste treatment and disposal should be done at the nearest possible location to its source in order to minimize health risks, and to reduce the logistic costs for waste management. It also added that there should be recycling or disposing of the waste generated by any community, inside their own territorial limits (Reese, 2018).

### **2.6.5 The prior informed consent principle**

Various international treaties mentioned this principle, as it entails that all parties involved in the generation, storage, transportation, treatment and final disposal of wastes that are hazardous and infectious, are to be registered or authorized to generate, receive and handle such categories of waste. In addition, only licensed sites and institutes can receive and handle the waste. The principle is designed for protecting the environment and health of people from many different types of hazardous wastes (Chartier *et al.*, 2014).

## **2.7 Legislation for health care risk waste management**

Health Care Risk Waste management is governed by legislation to ensure that environmentally achievable standards are met. Waldner (2011) stated that currently South Africa's health care waste is governed by several Acts, policies and regulations including: Occupational Health and Safety Act 85 of 1993; South African Constitution Act 108 of 1996; National Environmental Management Act (NEMA) 107 of 1998; White Paper on Integrated Pollution and Waste Management for South Africa of 2000; National Health Act 61 of 2003: Regulation relating to health care waste management in health establishments (R. 375 of 23 May 2014); National Environmental Management: Waste Act 59 of 2008: Proposed National health care risk waste management regulation (R. 462 of 30 April 2018).

### **2.7.1 Occupational Health and Safety Act 85 of 1993**

The Act regulates all health and safety matters. It provides regulations about the safety of operational workers in a workplace where biological agents are produced, used, handled or transported. The Act provides information, training for employees and the duties of people who might be exposed to risks. It provides information for risk assessment, medical surveillance and the provision of protective clothing, and sets regulations on the establishment of an occupation health and safety advisory council and its functions (Jansen *et al.*, 2017).

### **2.7.2 South African Constitution Act 108 of 1996**

The Constitution of the Republic of South Africa, Act 108 of 1996 is the ultimate source of law in South Africa, it provides the directive for waste management regulation (Hall, 2006). The Constitution contains a Bill of Rights in Section 24 that guarantees environmental rights, such as the right to access information and the right to administrative justice. It also states that everyone has a right to an environment that is not harmful to their health or well-being, to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. All HCRW management related legislation must therefore comply with the constitution.

### **2.7.3 National Environmental Management Act 107 of 1998 (NEMA)**

The NEMA was developed to give legislative effect to the White Paper on a National Environmental Management Policy for the country and it is a framework for protecting the environment. It ensures that waste is avoided, minimized, reused or recycled where possible or as a last resort be disposed of in a responsible manner. The Act requires for environmental management to be integrated and provides sections that are relevant to HCRW, mandates all organs of state to work together to ensure that the environment is protected through establishing guidelines for decision making in relation to the issues affecting the environment, establishing institutions that will implement and monitor compliance with the developed principles (Jansen et al., 2017). NEMA also provides legislation on Environmental Impact Assessment (EIA) through developing of tools and systems to manage the impact of activities on the environment (Department of Environmental Affairs, 1998). It is possible that if HCRW is incorrectly managed may cause such pollution or degradation of the environment.

### **2.7.4 White Paper on Integrated Pollution and Waste Management for South Africa, 2000**

This is a policy that was developed in partial fulfillment of the requirements of Agenda 21 of the Basel 1992 Rio Conference. It was developed at a time when there were fragmented and uncoordinated waste management plans and there were insufficient resources and monitoring of all legislations governing waste in the country. It is relevant to HCRWM as it addresses the prevention of pollution, waste, impact management and remediation, it encourages partnerships between government and the private sector. It states that sustainable development is an appropriate approach to ensuring resource management (Department of Environmental Affairs and Tourism, 2000).

### **2.7.5 National Environmental Management: Waste Act (NEM: WA) 59 of 2008**

According to DEA (2011), NEM: WA is regarded as a specific environmental management Act (SEMA) which ensure that there is waste management in South Africa. The main purpose of this act is to change the law that regulate waste management while protecting the environment (animals, plants, land, water and air) and the health of people. The Waste Act stipulates minimum requirements for any person undertaking an activity that generates waste or any waste handles which has already been generated to comply with it. The process includes waste storage, collection, transportation, treatment and disposal, it also includes people who waste



reuse or recycle waste. The NEM: WA provides norms and standards of regulating the waste disposal by the nation, specific measures of waste management, licensing and controlling of waste management activities, contaminated land remediation, national waste information system, enforcement and compliance (Jansen et al., 2017).

#### **2.7.6 National Health Act, 2003 (Act No. 61 Of 2003): Regulation Relating to Health Care Waste Management in Health Establishments (R. 375 of 23 May 2014)**

According to Government Gazette (2014), the regulation defined health care risk waste as a waste that is capable of producing any disease, but it is unlimited to the following: sharps cytotoxic chemical; genotoxic; pathological; infectious; radioactive; laboratory; and pharmaceutical waste. In general prohibitions, it emphasized that no health establishment may manage health care waste other than in accordance with these regulations and the national norms and standards relating to environmental health; or in a manner that may pose a risk to the environment and human health. Its environmental principles state that it is the duty of all health establishments that generate health care waste to safely dispose of the waste; to ensure that they are legally and financially responsible for the safe handling and environment sound disposal of the waste they generate; they must assume that the waste is hazardous until shown to be safe all the time; and it is their responsibility to manage waste properly from source of generation until its final treatment and disposal.

Scope of regulation indicates that provisions of this regulation should be applicable to all public and private health care establishments. The regulation should regulate how to handle, store, collect, transport, treat and dispose of health care waste. Health and safety minor and major generator should make sure that there is a health and safety policy in place. It also indicated that each major generator should have a health care waste management plan in place, with the contents consisting of health care services types provided; the categories of health treatment facility/ies utilized; care waste streams generated; the name and registration number of the transporter and treatment facility/ies used; and a waste management service rendering contract between the health establishment and the appointed waste management contractor.

The regulation also emphasizes on the enforcement, compliance and monitoring that the environmental Health Practitioners of the municipal or district should make sure that there is compliance, enforcement and monitoring of the regulations at the health establishments; and the environmental health practitioner of the municipal or district should conduct routine

inspections and environmental health investigations at the health establishments under the Act. According to this regulation, any person in charge of a health establishment who fails to comply with a provision of these regulation; and or submit inaccurate, false or misleading information about any matter required to be submitted in terms of the provisions of these regulations shall be guilty of an offence. Any person in charge of a health establishment convicted of an offence should be liable to a fine or to a term of imprisonment not exceeding two years or to both fine and imprisonment.

#### **2.7.8 National environmental management: Waste Act, 2008 (Act No.59 of 2008): Proposed National health care risk waste management regulation (R. 462 of 30 April 2018).**

From the government gazette (2018), the purpose of these regulation is to regulate the management of health care risk waste in a manner which supports and implements the provisions of the Act; prescribe the requirements for the management of health care risk waste such that this waste no longer constitutes a threat to humans, animals or the environment; prescribe the requirements for management of health care risk waste that ensures third party protection; and prescribe general duties of waste generators, waste transporters and waste managers. The regulation applies uniformly throughout the Republic of South Africa, it does not apply to domestic generators.

On general prohibitions, no person may dispose of HCRW to land unless authorized to do so by the Minister; discharge HCRW to municipal sewer without approval from the municipality in whose area of jurisdiction the activity is conducted ; place HCRW into a container that does not comply with the packaging requirements of SANS 10248-1' ( the latest edition of the South African National Standard for the Management of Health Care Waste, Part 1: Management of Health Care Risk Waste from a Health Care Facility) manually lift a container of HCRW weighing in excess of 15 kilograms including the container; transport HCRW over distances exceeding 50 meters unless it is protected by a rigid container; HCRW unattended in a place where unauthorized personnel or the public have unrestricted access; treat HCRW at a waste treatment facility not designed to accept and treat such waste; or dispose of waste residue to a waste disposal facility not authorized to accept such waste.

According to this regulation, health care risk waste must be separated from general waste at the point of generation. Health care risk waste must be segregated in accordance with SANS 10248 -1. Health care risk waste must be packaged in containers which are color-coded and marked in

accordance with SANS 10248 -1. Internal surfaces of a reusable container, excluding reusable sharps containers, must be protected by a liner. Non -reusable and reusable sharps containers must be designed and constructed in accordance with SANS 452 (the latest edition of the South African National Standard for Non -reusable and reusable sharps containers). Reusable containers must be thoroughly cleaned and decontaminated prior to reuse. Reusable sharps containers must be decontaminated in accordance with SANS 452.

Containers excluding liners and interim storage containers must be labelled in line with the waste classification and management regulations. A major generator must ensure that the labelling contemplated indicates the waste information registration number in accordance with the National Waste Information regulation. A minor generator must ensure that the labelling indicates that the contents were generated by a minor generator. A storage area used for storing HCRW must be inaccessible to unauthorized persons, where a separate storage room is used, must be secured by use of locks on entry doors or gates or container lids, sheltered from direct sunlight and rain, appropriately ventilated, vermin proof, must have access to a spill containment and clean -up kit, access to water to facilitate cleaning, an appropriate wastewater management system, adequate space for storing clean and dirty containers separately, and must be clearly signposted with appropriate warning signs on, or adjacent to, the exterior of the entry doors or gates, or on the containers.

On offences and penalties of this regulation, a person commits an offence if that person contravenes or fails to comply with a provision of regulations on general prohibitions, segregation, packaging, labelling and storage, duties of generator, a waste transporter and waste manager. Also, commit an offence if that person supplies false or misleading information in any record or document required or submitted in terms of these regulations. A person who commits an offence is liable on conviction to imprisonment for a period not exceeding 15 years, an appropriate fine, or both a fine and imprisonment.

## **2.8 Challenging or causes of improper management of health care risk waste**

Although there are legislations for health care waste management in place globally, it seems like there are still some challenges which cause improper management of HCRW. Challenges include lack of training and knowledge, lack of HCRW management guidelines, financial impropriety, lack of Personal Protective Equipment (PPE), such as proper segregation

containers and dedicated trolleys for transportation of waste from the wards to the temporal storage, and also lack of proper temporal storage in some establishments, as discussed below.

- **Knowledge, attitude and practices** of good management play a significant role in successfully management of HCRW, so the lacking adequate knowledge and practices shown to result in an increase in impacts on the environment and the spreading of infectious diseases to people (Adekunle et.al., 2018). Kumari *et al.* (2012) stated that in some places some healthcare operational workers do not follow the proper waste management guidelines, which were also revealed by one of the WHO studies that two thirds of hospitals among 22 countries were not following the proper HCRW management practices. Therefore, a continuous training on HCRW was suggested for health care operational workers to control the danger of infectious diseases that can potentially threaten the patients, personnel, and community in the neighborhood (Kumar *et al.*, 2015).
- **Financial impropriety by the Department of Health (DOH)** can be major challenge for managing HCRW to those who are responsible for removing, transporting and disposing HCRW out of the health care establishments (Hangulu, 2016). According to Dawar (2017) sometime the health care establishment handlers mix general waste with HCRW and dispose such waste on the roadside or open dumping site to eliminate the expense of the waste treatments and disposal. Raphela (2014) also noted that most of the waste management companies used open vans to transport HCW and the news stories framed the problem of used of inappropriate transport by waste companies to transport HCW as caused by lack of finances to purchase recommended vehicles.
- Hangulu (2016) study conducted in Kwazulu-Natal in South Africa pointed out that challenges or causes of improper management include **lack of personal protective equipment (PPE)** such as gloves, masks and boots used when handling waste and some companies do not provide such PPE. Which also show that in some health care establishments because of shortage of protective clothing such as gloves they were expected to improvise by wearing plastics as protective cloth, and some operational workers complained that plastics do not cover all the fingers as gloves do and therefore does not protect them from being exposed to HRCW.

- A study conducted in Limpopo health care establishments found that there is **no adequate segregation** from the point of generation as a result of lack of training and knowledge, which is a challenge of HCRW management (Raphela, 2014). According to Hangu (2013) lack of knowledge about segregation of HCRW, laziness to take out a full container and taking a new container, sometimes because of the long distance also lead to mixing of HCRW, for instance when the container of sharps is full and people responsible taking it to temporal storage are lazy it influences mixing of sharps with other HCRW, whereas sometimes mixing can be because of lack of sufficient bags or containers and lack of color-coding and labelling. Dawar (2017) explained that reasons of improper waste segregation include lack of knowledge, awareness and training of establishment operational workers from top to bottom, lack of proper check and balance system in hospitals, lack of interest by the hospital administration and employees.
- There is also **lack of sufficient dedicated trolleys** for onsite transportation and lack of use of appropriate transport was found to be responsibility of waste management companies (Hangu, 2016). In some health care establishments in South Africa Inadequate provision of storage receptacles was also found to be a problem for both risk waste and general waste (Kudoma, 2013).

According to the Department of Health (2007), rural and isolated health care establishments have no acceptable or even substandard HCRW treatment capacity available, which lead to the improper disposal methods including incineration, illegal dumping and disposal with municipal waste (Vumase, 2009).

## **2.9 Risks associated with non-compliance with health care risk waste management regulation**

Although the Regulation No. 375 of May 2014 on National Health Act No. 61 of 2003 of South Africa under general prohibition emphasized that no health establishment may manage health care waste in a manner that poses a risk or hazard to human and the environment, there is still an improper handling of HCRW which is a threat to human health directly through causing various deadly diseases and injuries as well as environmental contamination because of non-compliance with the regulation.

### 2.9.1 Impacts on human health

Health Care Risk Waste contains potentially microorganisms that are harmful and have potential to infect health care patients, health operational workers (doctors, nurses, laboratory technicians, paramedic staff and waste handlers) and the community (Rasheed *et al.*, 2005). According to Kumar *et al.* (2015) waste handlers or cleaners are the most vulnerable among health care workers to becoming infected by infectious waste due improper management and practices, and improper precautions taken by waste generators such as doctors and nurses

Pollution from poor treatment and handling of HCRW can indirectly have an impact to the health of the community, negative impacts include are many transmitted diseases such as viral hepatitis B and viral hepatitis C, AIDS which are transmitted through the exposure of wounds, acute medical needle contaminated with the blood of patients (Anozie *et al.*, 2017). Ahmed (1997) also added that because of lack of proper management, there are many significant health problems especially in developing countries such as skin allergies, eyes irritation, diarrhea, fever, cholera, typhoid, influenza and allergy are the most common problems especially among workers, patients and communities.

World Health Organization (WHO) estimated that in 2000, worldwide, injections undertaken with contaminated syringes caused about 23 million infections of Hepatitis B and Hepatitis C, and HIV. Clarke (2008) further stated that sharps which include syringes and needles, have the highest disease transmission potential amongst all categories of health care waste. Almost 85% of sharp injuries are caused between usage and subsequent disposal. Therefore, such waste needs proper handling as in a poor residential area it can be very risky because there can be situations where children play with HCRWs such as syringes.

### 2.9.2 Environmental Impact

Improper HCRW management indirectly or directly affects the entire environmental system in the form of water and soil contamination, which also affect food and natural vegetation. The improper disposal of HCRW, especially in health care institution without former treatment directly into sewerage water, contaminate water resources as well as aquatic flora and fauna, which also directly affects the fisheries potential, mullet, sea breams, shrimps and other bottom fishes of the creeks and harbor. The decomposed HCRW also causes unpleasant smell and visually looks unattractive (Ahmed, 1997).

The treatment of HCRWs with chemical disinfectants has high potential of releasing of chemical substances into the environment if those substances are improper handled, stored and disposed of or in a manger that is not environmentally sound. According to Vorapong (2009), most of the health care establishments that use incinerators that were inappropriately operated and managed, and which release toxic air pollutants, which is harmful to all living things, as HCRW typically comprises of a variety of plastic materials such as Polyvinyl Chloride (PVC).

The nature and quantity of health care waste generated, and management practices in the establishment regarding sustainable methods of health care waste management, which include segregation and recycling, are often examined poorly and documented in several countries of the world and inappropriate management of HCRW is increasing significant health hazards and pollution on the environment due to the infectious nature of the HCRW (Oke, 2005).

### **Chapter summary**

This chapter focuses on the theoretical reviews and legal background related to HCRW management, the information was gathered through examining existing and reliable information from different secondary data such as internet websites, journals, articles, books and policies related the management of health care risk waste. It highlighted the important of complying with regulation, which also benefits on people's health a protected environment for them. The chapter provides challenges or causes of not complying with the regulation, which lead to improper management of HCRW. Since the study is assessing the level of compliance with regulation the researcher also tries to align the study to the different legislations, policies and regulations in South Africa. It was revealed that most health care establishments are facing challenges with regard to health care risk waste management.

## CHAPTER 3 : MATERIALS AND METHODS

### Introduction

This chapter outlines the research methodology. In order to understand the part of methodology, there are sub-themes that were used in the study for instance, research design, purpose of the study, population, and, location, sampling procedure, data collection method, instrument, analysis, levels of measurement, ethical considerations, and, limitations of the study.

### 3.1 Research design

Mothibi (2015) defines research design as “a master-plan specifying the methods and procedures which are used to guide research implementation”. Polit and Beck (2008) also stressed that that a research design “provides the basic strategies that are necessary for the development of empirical evidence.” Therefore, this study consists of mixed method which combines both quantitative and qualitative methods (Johnson *et al.*, 2007). The convergent parallel type of mixed method was employed in this study because collection and analysis of both quantitative and qualitative data was done concurrently, and the results were compared and interpreted together).

Quantitative research method provides answers to questions about relationships between measurable variables (De Vos *et al.*, 2010), while qualitative research method is primarily exploratory research and gives an in-depth understanding of underlying opinions and reasons (Maxwell, 2012). The flow chat in Figure 3.1 (Page 30) shows methods and procedures that were used in this study and Table 3.1 (Page 31) shows the data collection methods and procedures that were incorporated to achieve specific objectives of the study in the form of goal achievement matrix.



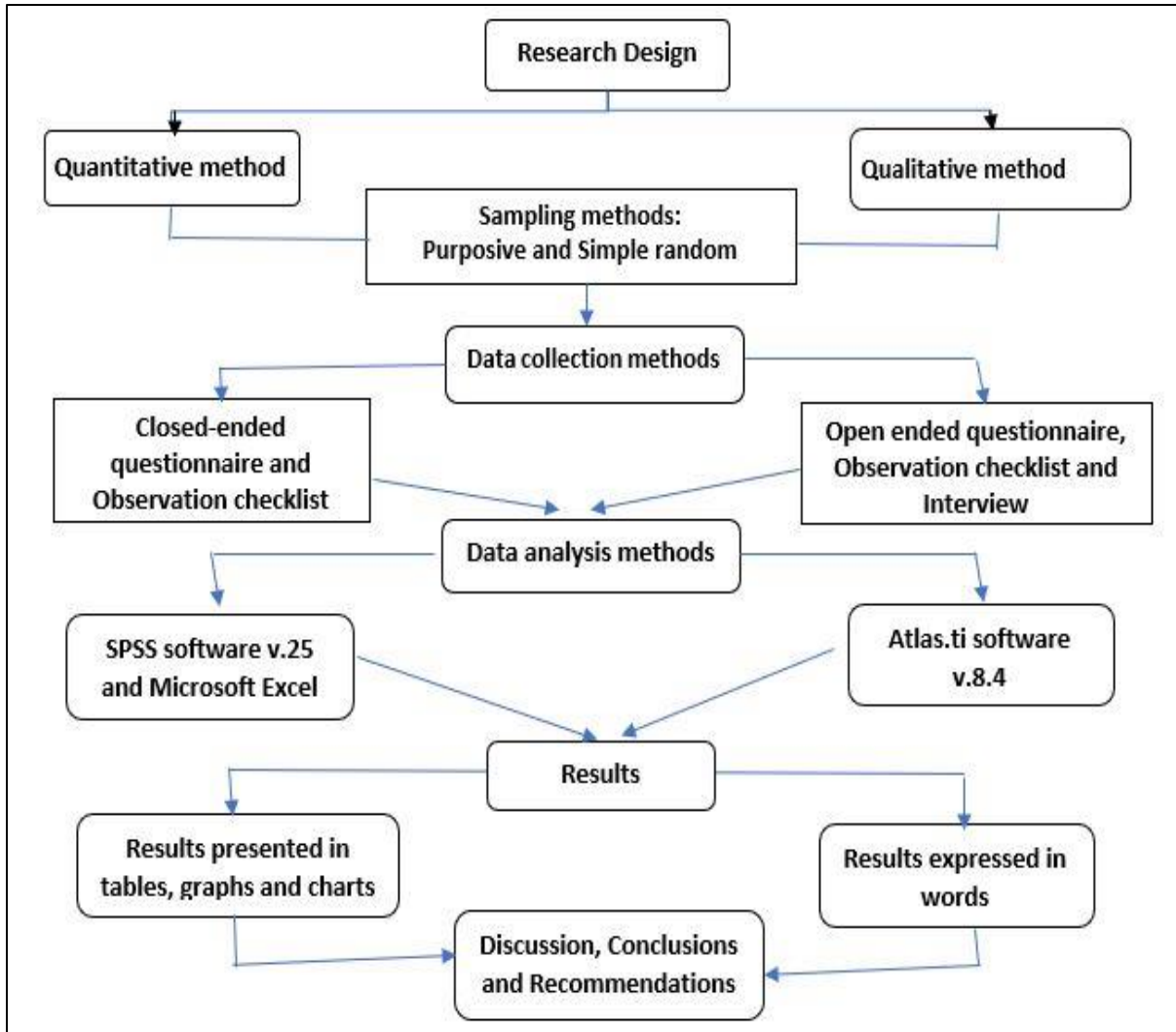


Figure 3-1: Flow chart of the methods and procedures used in the study

Source: Researcher's own construct

Table 3-1: Goal achievement matrix adopted in the study

Research objectives	Data collection method	Sampling	Analysis and data presentation	Outcomes
1. To identify the types of Health Care Risk Waste (HCRW) generated	<ul style="list-style-type: none"> <li>• Questionnaires to the nurses and doctors in identified clinics and hospitals</li> <li>• Observation checklist</li> </ul>	<ul style="list-style-type: none"> <li>• Purposive sampling (15 clinics) 3 hospitals</li> <li>• Simple random (specific clinics)</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative data analysis- SPSS and Microsoft excel, presented in tables, graphs and charts</li> <li>• Qualitative data analysis-Atlas.ti, presented in text</li> </ul>	The study helped in identifying the types HCRW being generated in some health care establishments in TLM
2. To evaluate the level of knowledge of administrators and operational workers regarding HCRW management	<ul style="list-style-type: none"> <li>• Interview (administrators)</li> <li>• Questionnaires (nurses, doctors, and cleaners in identified clinics and hospitals)</li> <li>• Observation checklist</li> </ul>	<ul style="list-style-type: none"> <li>• Purposive sampling (15 clinics) 3 hospitals</li> <li>• Simple random (specific clinics)</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative data analysis- SPSS and Microsoft excel, presented in tables, graphs and charts</li> <li>• Qualitative data analysis-Atlas.ti, presented in text</li> </ul>	The level of knowledge of administrators and operational workers regarding HCRWM in TLM health care establishments was established
3. To determine if health care administrators and operational workers comply with the regulation regarding HCRW management	<ul style="list-style-type: none"> <li>• Interview (administrators)</li> <li>• Questionnaires (nurses, doctors, and cleaners in identified clinics and hospitals)</li> <li>• Observation checklist</li> </ul>	<ul style="list-style-type: none"> <li>• Purposive sampling (15 clinics) 3 hospitals</li> <li>• Simple random (specific clinics)</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative data analysis- SPSS and Microsoft excel, presented in tables, graphs and charts</li> <li>• Qualitative data analysis-Atlas.ti and presented in text</li> </ul>	The level of compliance with current HCRW management regulation in TLM health care establishments was determined
4. To identify challenges faced by administrators and operational workers in health care establishments on HCRW management and compliance with the Regulation	<ul style="list-style-type: none"> <li>• Interview (administrators)</li> <li>• Questionnaires (nurses, doctors, and cleaners in identified clinics and hospitals)</li> <li>• Observation checklist</li> </ul>	<ul style="list-style-type: none"> <li>• Purposive sampling (15 clinics) 3 hospitals</li> <li>• Simple random (specific clinics)</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative data analysis- SPSS and Microsoft excel, presented in tables, graphs and charts</li> <li>• Qualitative data analysis-Atlas.ti and presented in text</li> </ul>	Challenges of managing HCRW and compliance with the regulation in health care establishments in TLM were identified

## 3.2 Target study population and sampling

### 3.2.1 Population

The study area focused on the health care establishments found in Thulamela Local Municipality, which has 59 health care establishments, of which 3 are hospitals, 42 are clinics and 14 mobile clinics. Mobile units do not have a specific location and waste generated is collected and recorded at the nearest clinics, this study focused only on hospitals and clinics. The population of a study refers to the total group of the subjects that comprise of the entire group of people that is of interest to the researcher and to whom the research can able to draw conclusions from the results (Graziano and Raulin, 2013).

### 3.2.2 Sampling

According to Ramataboe (2015), a sample is a representative of the population that helps the researcher to obtain information necessary for meeting the objectives of the study and it is more manageable to work with than the entire population. There are many different forms of sampling techniques which can be used to obtain a sample based on the type of the study and information required in the study.

- **Purposive sampling**

Purposive sampling allows the researcher to use own specific criteria set and judgment in selecting samples. Furthermore, participants selected are having answers to research questions and study's objectives (Sarandakos, 2013). Therefore, in this study, purposive sampling was used to select 35% of clinics which is 15 clinics, because 96% of clinics in Thulamela Municipality provide similar services, they have more similar information, thus there is no need to have a large size and getting the same information. Manzi *et al.* (2014) also maintained that purposeful sampling methods helps in achieving data saturation faster because of more precise investigation and more informed participants. Singh and Masuku (2014) had also suggested that a sample size of between 20-35% is adequate to fulfill data collection objectives.

- **Simple random sampling**

Simple random sampling is a technique which shows that every individual in the sample has equal chance of being selected. The technique provides unbiased and better estimation of the

parameters if the population is homogeneous (Singh and Masuku, 2014). Therefore, simple random sampling from Microsoft excel was used in this study to select 15 clinics (Fig. 3.2). Since there are only three hospitals (Donal fraiser, Tshilidzini and Hayani Psychiatric Special hospital), all of them were selected (total sampling).

### Steps to select random sample in Excel (Svetlana, 2019)

**Step 1:** add data to a new column within the spreadsheet and name it names of clinics

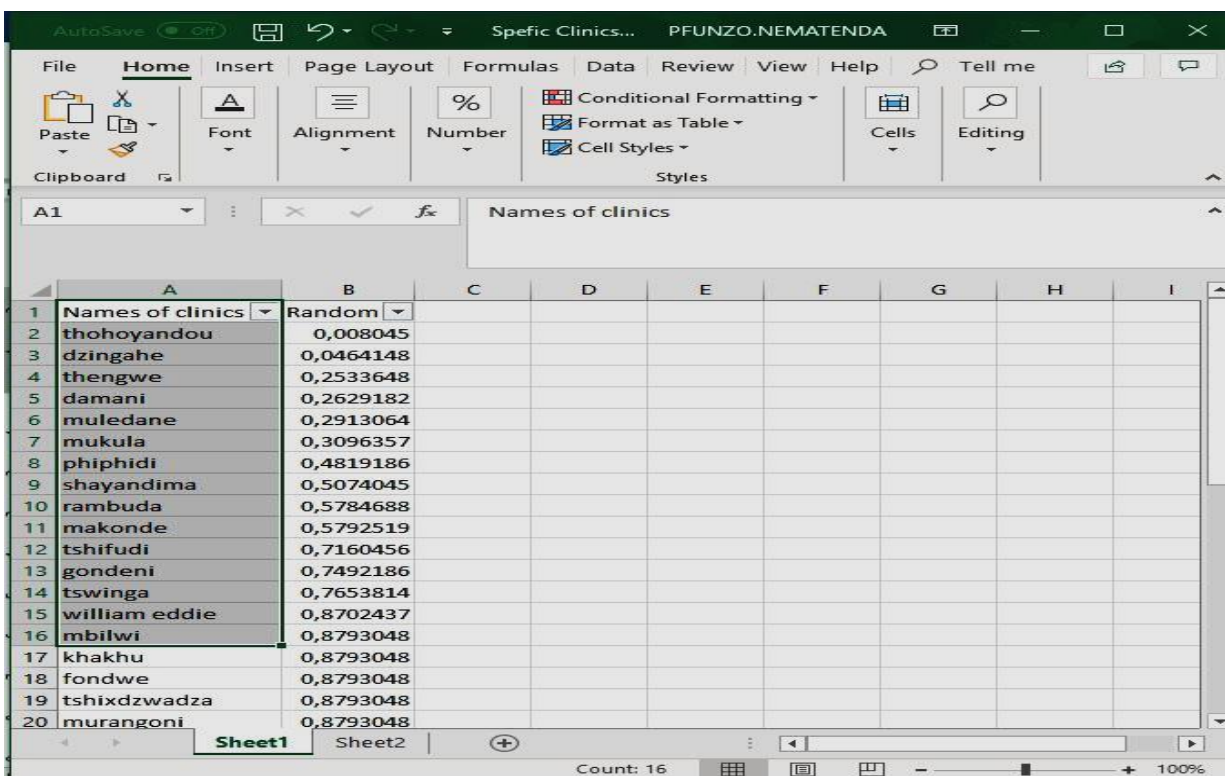
**Step 2:** In the first cell underneath your heading row, type “= RAND ()”

**Step 3:** Press “Enter,” and a random number will appear in the cell

**Step 4:** Copy and paste with paste value the first cell

**Step 5:** Once each row contains a random number, highlight all data and select sort by “random”

**Step 6:** Choose the first 15 clinics



Names of clinics	Random
thohoyandou	0,008045
dzingahe	0,0464148
thengwe	0,2533648
damani	0,2629182
muledane	0,2913064
mukula	0,3096357
phiphidi	0,4819186
shayandima	0,5074045
rambuda	0,5784688
makonde	0,5792519
tshifudi	0,7160456
gondeni	0,7492186
tswinga	0,7653814
william eddie	0,8702437
mbilwi	0,8793048
khakhu	0,8793048
fondwe	0,8793048
tshixdzwadza	0,8793048
murangoni	0,8793048

Figure 3-2: Selected clinics selected for the study.

### 3.3 Data collection methods and instruments

The process of data collection is very essential to the success of a study because the higher the quality of data collection method, the higher the accuracy of research conclusion (Brink *et al.*, 2006). Primary data was used, and data was collected through the use of semi-structured interview and semi-structured questionnaires containing both open-ended and closed-ended questions. An observational technique using checklist was also employed for the data collection. To establish the level of compliance with the regulation (R. 375 of 23 May 2014), the following indicators from the regulation were checked: health care waste management plans; health care management team and committee; identification, labeling and segregation of health care risk waste (HCRW); HCRW storage; collection and transportation; treatment and disposal.

#### 3.3.1 Interview

An interview has been defined as “a conversation for gathering information in which an interviewer, who coordinates the process of the conversation and asks questions, and an interviewee, who responds to those questions” (Easwaramoorthy & Zarinpoush, 2006). There are several types of interviews for example ‘telephone interview, knowledge transfer, computer-assisted telephone interviewing, mall intercept interview, online interview, unstructured interview and structured interview’. Hence, for this study the researcher chose semi-structured interview to gather an in-depth information from participants.

Leedy and Ormrod (2010) described semi-structured interviews as an instrument that involves pre-determined questions as well as allow for further questioning, curious participants’ reasoning and interpretations in order to understand their assumptions and behaviours. According to Kudoma (2013) an interview involves direct communication between the researcher and research subjects. Semi-structured interviews give more freedom of discussion with subjects and aim for a greater understanding of the subjects, it allows the subjects to expand upon the questions. Therefore, in this study face-to-face semi-structured interview was used to interview 18 health care establishment administrators or managers in the study and the questions guide were prepared based on the research objectives (Appendix 3). Face-to-face method was found to be applicable as it helped to note specific reactions, clarify and follow-up questions, and judge when respondents were not giving honest answers. Participants were made to feel free and relaxed, and they were allowed to answer the questions according to their own preference and all questions was specific. Each interview was scheduled to last at least 30 minutes, so all

participants had enough time to respond to all questions and their opinions and responds were well understood. The interviews were audio-recorded anonymously, without mentioning the name of the respondent or the name of the establishment.

### 3.3.2 Questionnaire

According to Abawi (2013), a questionnaire is a reliable data collection instrument consisting of a series of questions for gathering information from respondents. In this study, semi-structured, self-administered questionnaire was utilized because it allowed respondents to give their views anonymously and this reduces bias from the researcher's own opinion (Sarantakos, 2013). Semi-structured questionnaires (Appendix 4) were distributed to the health care operational workers (nurses, doctors and health care waste cleaners) of the selected health care establishments in Thulamela Local Municipality.

Though the researcher aimed to distribute 183 questionnaires to be completed in the study, however 200 questionnaires were distributed, for in case if some get lost or not completed. A total of 167 questionnaires were completed (Table 3.2) with the reason that some staff were not willing to participate, some were busy, and, in some establishments, there was shortage of staff, and data saturation has been reached when additional investigation yields no new or additional evidence about further information and themes. A participant spent approximately 30 minutes to complete the questionnaire. Data was collected on weekdays (Mondays to Fridays) during lunch hour to avoid interfering with the official duty time of participants.

Table 3-2: Questionnaires distributed to the operational workers

	<b>Number of questionnaires distributed in 15 clinics</b>	<b>Number of questionnaires distributed in 3 Hospitals</b>	<b>Total</b>
<b>Doctors</b>	0	25	<b>25</b>
<b>Nurses</b>	80	29	<b>109</b>
<b>Waste cleaners</b>	21	12	<b>33</b>
<b>Total</b>	<b>101</b>	<b>66</b>	<b>167</b>

The questionnaires for operational workers (doctors, nurses, and waste cleaners) had four sections: sections with demographic characteristics questions, section that identified types of HCRW generated, section that assessed the level of knowledge of operational workers and their HCRW management and lastly the section for recommendations and comments (Appendix 4).

### **3.3.3 Observation checklist**

Observational technique was employed using checklist (Appendix 5) to record findings observed on HCRW management at the identified health care establishments and photographic evidence was taken for the observed phenomenon. Observation entails the investigation of research subjects in a natural environment with attention paid to the subjects' behavior and actions (Polit and Beck 2008). Checklist for observation consisted of four sections: section which check if there is HCRW segregation and color-coding containerization; section which check HCRW storage; section which looks into HCRW collection and transportation and lastly the section which check protective clothing for waste collection.

### **3.4 Instrument validity and reliability**

Data collection instruments refer to devices used to collect data. Such instruments include: questionnaires, observation, checklist and semi-structured interview (Seaman, 1991). According to Porota (2012) although validity and reliability are associated mainly with quantitative research which involves questionnaires as a data collection instrument, they are also necessary in qualitative research that involves interviews as a data collection instrument in order to assist with confirmation of the data collected. The fundamental features in the evaluation of any measurement instrument for a good research results are the measurement of reliability and validity of the research. Therefore, in this study to ensure satisfactory results, there was validity and reliability measurements for the semi-structured interview questions, semi-structured questionnaire and observation checklist.

#### **3.4.1 Validity**

According to Zikmund *et al.* (2013), validity refers to the extent to which the study's findings accurately depict the phenomenon being studied. In this study face and content validity of the instrument was determined. Face validity refers to whether the instrument looks like it is measuring the appropriate construct or not (Polit and Beck 2008). The researcher ensured face validity by careful selection of items to be included in the interview and questionnaire such as management of HCRW. Polit and Beck (2008), define content validity as the degree to which an instrument has an appropriate sample of items for the construct being measured. To ensure content validity, the developed interview guideline and questionnaire was presented for review

to a statistician, senior colleagues and the supervisor to make an input because of their experience in practice.

### **3.4.2 Reliability**

Reliability refers to the extent of consistency with which an instrument measures whatever it is intended to measure (Phelan and Wren, 2012). According to Hilton (2015), pretesting is a method that checks if instruments such as interview guideline, questionnaire and observation checklist work as intended, and to check if the questions are understood by individuals who are expected to answer them. It also reduces the chances of errors and increases responses rate. In this study the reliability was confirmed through conducting pretesting of the interview guideline, questionnaire and observation checklist. The two administrators or managers were interviewed, questionnaire was administered to 4 nurses and 2 waste cleaners in one clinic (Thohoyandou clinic) in Thulamela Municipality, as questions for interview and questionnaire were found to be relevant for the study.

### **3.5 Data collection limitations**

The following are some of the limitation faced by the researcher during data collecting:

- The main objective of the study was to assess the level of compliance with the regulation relating to health care waste management (R.375 of 23 May 2014) in health care establishments in Thulamela Local Municipality. The researcher also aimed to include waste transporters in data collection, but due to time and accessibility the researcher was not able to meet with the transporters.
- Another data collection limitation is that some doctors and nurses, most doctors could not complete the questionnaire with the reason that they are very busy. Some cleaners could not complete the questionnaire because they are old and couldn't write or read, whereas some did not show any interest in helping even if the researcher was going to read for them. In some health care establishments, some respondents insisted that the researcher should leave the questionnaires and come another day for collection, but researcher found some questionnaires unanswered and some even lost.



### 3.6 Ethical considerations

Berg and Lune (2012) explain ethics in research as the concept of “Do Not Harm” referring to avoid any emotional and physical harm. According to Brink *et al.* (2012), ethics is a set of rules or standards that regulate people and animal’s lives and used for decision making. The ethical issues adhered to during this study included permission for the study, informed consent,

- **Permission for the study**

The research proposal was presented and supported by the School of Environmental Sciences’ Higher Degrees Committee and afterwards submitted to the University Higher Degrees’ Committee for approval. Ethical clearance was obtained from the University of Venda Higher Degrees’ Committee (Appendix 6). The authorisation for conducting the study was also obtained from Limpopo Department of Health (Appendix 7) as well as from the Vhembe District Department of Health (Appendix 8).

- **Informed consent**

Informed consent letter was used to inform the respondents that the participation to the study is voluntarily and ensured that the participants understand the purpose of the study, procedure, and potential benefits as explained in the information sheet including the fact that the participation is voluntary, and they are free to withdraw at any time without any penalty (Appendix 1). Avoidance of harm was considered to ensure that there was no emotional and physical harm to the participants. Anyone who volunteers to participate was requested to sign a consent form before he/she is given the questionnaire to complete or respond to the interview (Appendix 2).

#### Respect for human dignity

This implies that participants have the freedom of individual actions and choices to decide whether to participate in the study or not (Bless *et al.*, 2013). It also emphasizes that respondents should be informed on how confidentiality and anonymity are ensured. Confidentiality of all the information obtained from the respondents was maintained, as it would not be used for any reason other than for this research and the anonymity of the respondents were also ensured by not using the respondents’ names on the questionnaires and interviews. The right to privacy for the respondents was maintained by asking only questions which are relevant to the aim of the study (Polit and Beck, 2008).

- Non-maleficence

Non-maleficence means that researchers have an obligation not to impose harm on their study participants. It was a researchers' reasonability to ensure that research which carries a risk of harm was only conducted by properly qualified investigators. Therefore, the researcher protected the contributors from any physical, psychological, emotional, inconvenience or discomfort harm (De Vos *et al.*, 2005). This study poses no harm to the participants, only their time was required to participate in the study.

- Beneficence

It refers to a duty to harm maximise and minimise benefits (Polit and Beck, 2008). This also includes the freedom from exploitation, benefits from the study through potentially contributing to the well-being of others and the degree of risks should not outweigh the benefits of the study (Bless *et al.*, 2013). Respondents were informed about the benefits of the study, which is improving the HCRW management in the institution.

- Justice

This refers to fairness and equity which relate to the respondents' rights to fair treatment, privacy, anonymity and confidentiality (Polit and Beck, 2008). In this study, the respondents were fairly and equally treated, getting into respondents' 'private affairs were avoided, a code or number was used instead of respondents' names and information collected was strictly confidential.

### **3.7 Data analysis**

Data analysis is a process of examining and interpreting data to get meaning and gain understanding (Grove *et al.*, 2013). Creswell (2009) describes data analysis as a way of making sense out of text and image, moving deeper into understanding the data, representing the data and making interpretation of the larger meaning of the data. Close-ended responses from the questionnaire and observation checklist which are quantitative data were analyzed using Statistical Packages for the Social Sciences (SPSS) version 24 to obtain the interrelationship of responses from administrators' interview and operational workers' questionnaires. SPSS is a package of programs for manipulating, analyzing, and presenting data and is widely used in the social and behavioral sciences, although now is popular in other fields as well (Field, 2013).

Microsoft excel was also to be used to find description statistics such as mean, frequencies, variance and standard derivation.

Open-ended responses from both the interview and questionnaire and which was qualitative data were analyzed using the Atlas.ti version 8.4. As the methods of data analysis mostly involved examining, labelling and organizing interview transcriptions into themes, data were imported to Atlas.ti, coded and categorized into themes which were organized according to the specific objectives of the study and the research questions. Quantitative information generated from close-ended questions analyzed was presented in the form of graphs and tables. Whereas qualitative information collected from open-ended interview and questionnaires was expressed in words to provide visual interpretations and to draw conclusions for the obtained data. All data analyzed from SPSS and Atlas.ti helped to generalize the results obtained in order to make conclusions and recommendations on improving HCRW management.

## CHAPTER 4 : RESULTS AND DISCUSSION

### Introduction

This chapter presents results and discusses for data that were collected using semi-structured interview from the administrators; semi-structured questionnaires from the operational workers (doctors, nurses and cleaners); and observation checklist used to check the HCRW handling and management in health care establishments. Quantitative data from which was composed of open-ended questions were analysed using the Atlas.ti version 8.4. Quantitative data collected from semi-structured questionnaires were analysed using SPSS version 25. The collected data were analysed and presented in form of frequencies and percentages as well as in graphs. From the 18 selected health care establishments in the study, one administrator in each establishment was interviewed, and a total of 167 out of 183 questionnaires were completed by the operational workers, translating into a response rate of 91.26%. Figure 4.1 below indicates the thematic framework outlining the key study themes and subthemes that were presented in this chapter.

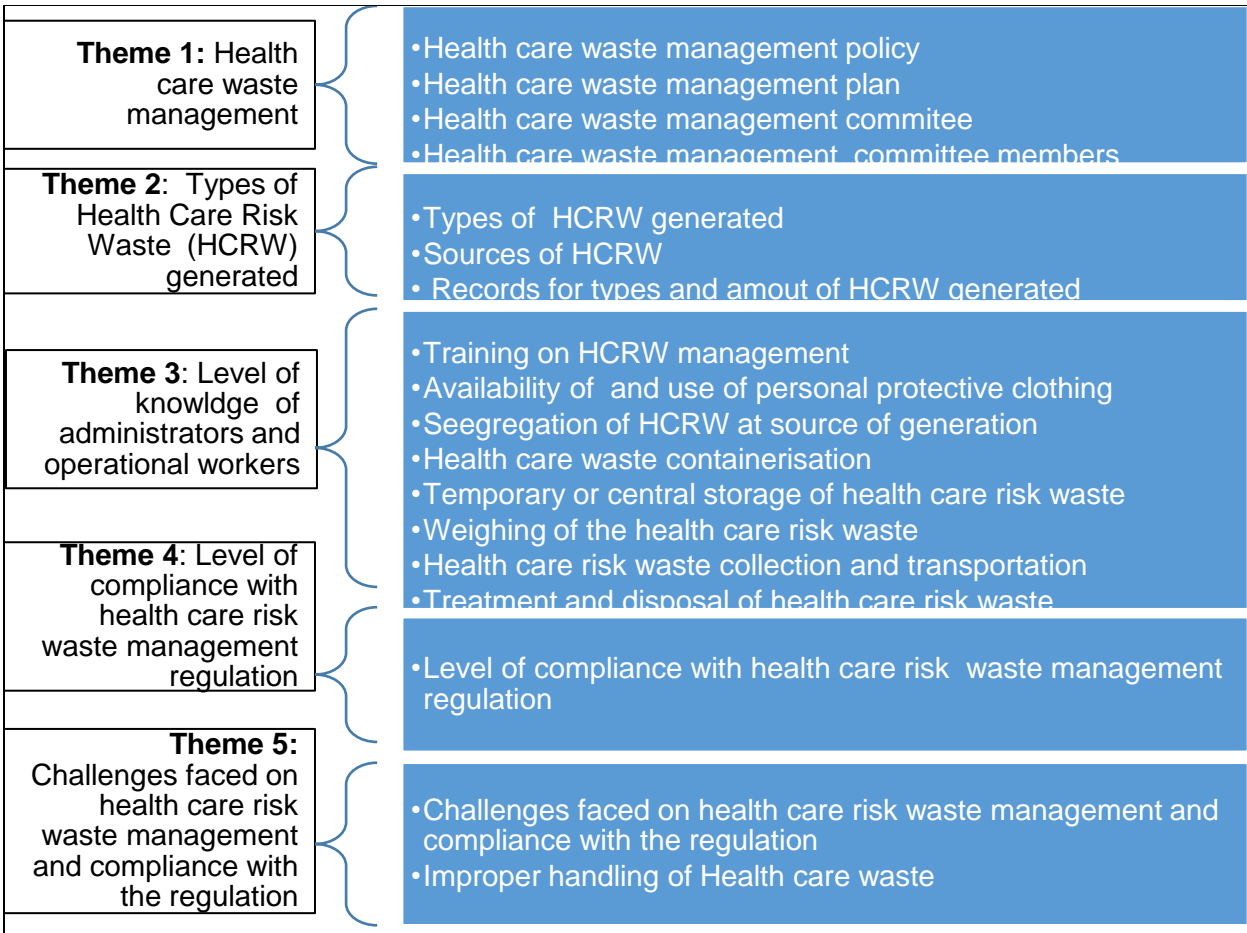


Figure 4-1: Themes emanating from data analysis

Source: Researcher's own construct

#### 4.1 Demographic information of respondents

Demographic characteristics of the respondents have very significant role for expressing the responses about the problem (Chappelow, 2019). In this study, personal characteristics such as occupation and years of experience were identified to understand the variables against compliance with the regulation. Davis and Shannon (2011) recommended that to truly know the respondents and the types of information given, it can be done by analysing the respondents' demographics. Respondents' occupations have an influence on their personality and response to a problem or question. Years of experience in this study assist in determining the level of knowledge of the respondents, and it also gives the researcher an understanding of how the respondents responded to the questions.

#### 4.1.1 Years of experience of the respondents in health care establishments

In this study, it was found that years of experience of the administrators differ from the years of experience of the doctors, nurses and cleaners. Table 4.1 represents the frequency distribution of the number of years of experience in HCRW management in health care establishment, which shows that administrators have more years of experience than operational workers because in most cases one health establishment has one manager and their progression to higher levels is limited. Therefore, the higher the number of years, the more they accumulated information related to the institution.

Table 4-1: Administrators and operational workers' years of experience

Variables for years of experience	Frequency	Percentage
<b><u>Administrators (Managers)</u></b>		
8-11 years	3	16.7%
12-15 years	4	22.2%
16 years and above	11	61.1%
<b>Total</b>	<b>18</b>	<b>100%</b>
<b><u>Operational workers (doctors, nurses and cleaners)</u></b>		
0-3 years	19	11.4%
4-7 years	34	20.4%
8-11 years	38	22.8%
12-15 years	25	15.0%
16 years and above	51	30.5%
<b>Total</b>	<b>167</b>	<b>100%</b>

The results show that there were no administrators within the category of 0- 3 years. Only 3 (16.7%) administrators fall in a range of 8-11, while 4 (22.2%) are from 12 -15 years of experience and most administrators (61.1%) have 16 years of experience and more. Only 19 (11.4%) operational workers have 0-3 years of experience, while 25 (15%) are from 12-15 years of experience, 34 (20.4%) are from 4-7, 38 (22.8%) from 8 -11, and 51 (30.5%) of them were found from 16 years of experience and above. Therefore, it can be concluded that there are more operational workers that have more experience in the management of HCRW. More experienced operational workers might understand compliance faster if there is effective implementation of compliance regulation principles

## 4.2 Awareness on the health care waste management policy

In this study, compliance level of health care establishment with current health care risk waste management regulation was guided by the Regulation relating to health care waste management in health care establishments, which is regulation number 375 of 23 May 2015. As proffered by the respondents, the results indicate that compliance should be aligned with objectives of health care waste management regulation. The 18 health care administrators interviewed stated that they have health care waste policy document given by the Provincial Department of Health, which is accessible to everyone, and that policy contains guidelines on how to manage waste generated. From the administrators interviewed, most (89%) of them were found to be aware of the objectives of the policy which are for infection control and environmental hygiene. Furthermore, they were aware of the purpose of the policy to ensure proper management. During the interview, Respondent 1's sentiments are shown in the following excerpt:

*"The objectives of the policy are for infections control and for the cleanness of the facility."*  
**(Respondent 1)**

While Respondent 13 reported that:

*"Objectives are that health care waste are not supposed to be burnt, health care general should be collected by the municipality, and health care risk waste should be putted in segregated area and collected by the company that signed the contract with the department, Buhle private company"*  
**(Respondent 13)**

The remaining 2 administrators (11%) however, indicated that they know that the document is available, but they are not sure about its objectives. Respondent 4's expressions are shown in the following quotation:

*"Sadly, to be honest, I'm not sure, I don't know about the policy objectives."* **(Respondent 4)**

And respondent 3 reported that: *"I know that the policy for health waste management is there in this facility, I am just not sure about the objectives of it."* **(Respondent 3)**

### 4.3 Health care waste management plan

The policy gives the guidelines that help in development of plan on proper management of health care waste. According to the regulation (R. 375 of 23 May 2014) each health care establishment should have health care waste management plan, and the content of management plan should include the types of health care waste generated; monthly generation rates recorded, details of the person in charge (chief executive officer / facility manager); details of the health care waste officer, the scope of the health care waste officer's duties; the scope and objectives of the health care waste management plan including evaluation of technologies, procedures and personnel; an on-going education and training programme on health care waste management to be developed for employees; the hazardous properties of the waste, the safety of its patients and employees, economic costs and savings; and measures to implement an effective management of spills during handling, collection and removal of health care waste.

The results in the study indicate that most (77.8%) of the health care establishments have health care waste management plan, as it is also confirmed by the respondent 1 and 18's views. However, some (22.2%) health care establishments did not have management plan, which is an indication of non-compliance with the regulation. These findings are based on the expressions of respondent 1, 13 and 18 shown in the following quotations.

*“Yes, we have a plan that I told you about that shows that we don't burn waste but put them in segregated area that I will show you after the interview.” (Respondent 1)*

*“No, I think plan is with the district, because a lot of things are filed at the district, if we have it in this facility it will be in the manager's office, I am second in charge manager” (Respondent 13)*

*“We do have the plan, more especially on proper segregation and proper storage of waste” (Respondent 18)*

A study conducted by Vumase (2009) revealed that 66% of hospitals in Limpopo province have management plan, which means that 34% were not complying; all hospitals in Gauteng province were confirmed to have management plan; whereas none of the hospital in Eastern Cape and Free State provinces have waste management plan. Motlatla (2015) also established that 45.5% of the 11 hospitals in Northern Cape Province had developed health care waste management plans, though the respondents indicated that those plans were not available to all staff members.



The study also pointed out that the health care waste management plan helps with the development of norms and standards for employee health and safety (Motlatla, 2015). In this study, it was found that more health care establishments have HCW management plans, however, an improvement is still needed, because lack of management plan in a health care establishment entails employees and patient's health and safety risk as the ultimate result.

#### **4.4 Health care waste management committee and committee members**

##### **4.4.1 Health care waste management committee**

Health care waste management planning is considered functional only if the management team has been recognized (Motlatla, 2015). According to the Regulation the administrator or person in charge of the health care establishment should establish a health care waste management team or committee (R.375 of 23 May 2014). This study considered HCW management committee essential for proper management, as it facilitates and coordinates all health care waste management issues within the health establishment. The results in this study showed that most (72.2%) of the administrators are active in management committees, with the remaining espousing that there is no are management committees available in their establishments. Respondent 9 and 18's sentiments are shown in the following excerpt.

*"No, we don't really have one, because they have few operational workers, so they just appoint one person to do the duties of the committee members for the day." (Respondent 9)*

*"At the moment we do not have properly functioning committee, the challenge is the workload and we don't have time for meetings to sort out this issue, some sometimes we just do them informally so, and select a person to do the work for that day." (Respondent 18)*

These findings indicate that there are some health care establishments which are still not complying with the regulation. A study conducted by Vumase (2009) in four hospitals revealed that health care waste management committee has active committee members, as it is a fundamental part of the hospital organisation. Consequently, 70% of the health care establishments indicated that they have a management committee however, an improvement is still needed for proper management to all establishments.

#### 4.4.2 Health care waste management committee members

According to the Regulation, the management plan should have management committee composed of: chief executive officer / establishment manager, who oversees the day-to-day administrative operations of health care establishment, ensuring compliance with the regulations, and coordinating with operational workers to identify their issues and needs; designated health care waste officer with duties to ensure that there is minimization of health care general waste in terms of reduce, reuse, and recycling, and to monitoring process of health care waste management from proper segregation to the transportation outside the establishment. There should be a representative from procurement, which is responsible for organisation of purchase orders; representative responsible for cleaning and hygiene services; occupational health and safety officer; infection and prevention control officer; quality control officer; and environmental health practitioner. In this study, it was found that not all establishments have all committee members. Figure 4.2 summarises these results.

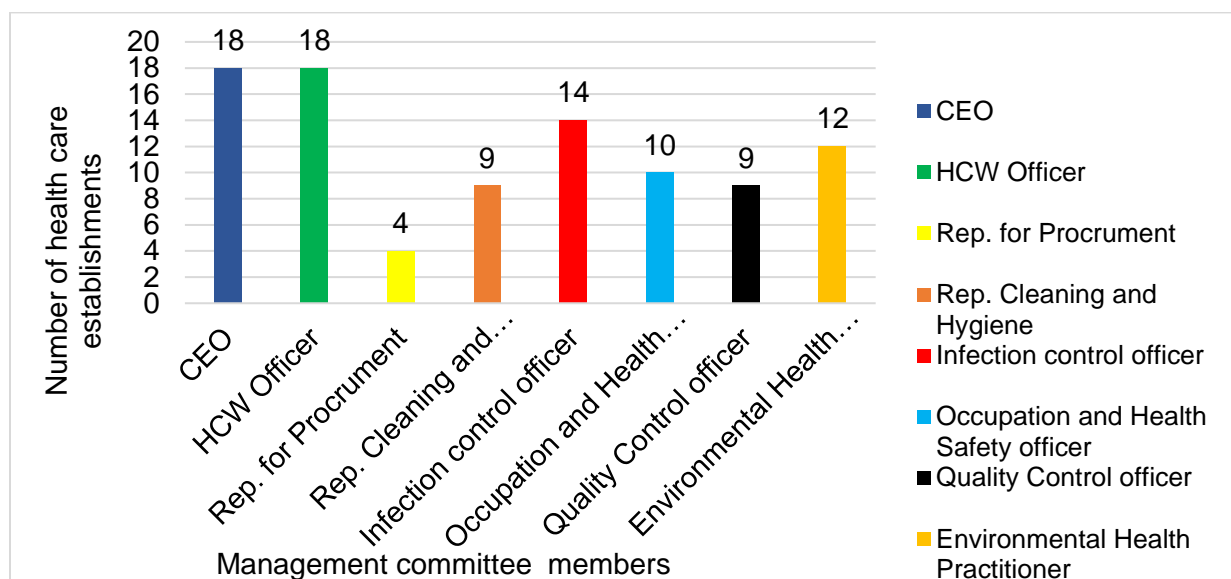


Figure 4-2: Available HCW management committee members

Fig.4.2 gives the total number of Chief Executive Officer (CEO) available in the 18 investigated health care establishments within Thulamela Local Municipality, although referred as managers in clinics. Health Care Waste Officers are also found in the 18 health establishments in the study area, 14 establishments had infection and prevention control officers, whereas 12 had environmental health practitioners. Occupation and Health Safety Officers were found to be in

10 establishments, 9 reported that they have representative of the section responsible for cleaning and hygiene services, whilst the other 9 had quality control officers and safety officers, and only 4 health care administrators reported that they have representatives from procurement.

A similar study conducted by Motlatla (2015) shows that there was non-compliance among HCW management committee members, which is not only a non-compliance with national regulation, but also with WHO recommendations. It was found that cleaners were responsible for the collection and transportation of health care waste from the ward to the temporary storage, but they were not completely compliant with the regulation as some full HCRW bins were found not collected and cleaners responsible reported that they were not aware that they are full. It therefore shows that there can be a management committee without relevant member doing their duties, leading to improper waste management.

#### **4.5 Health care waste management process**

##### **4.5.1 Training and knowledge on health care risk waste management**

The Regulation on health care waste states that the first step of health care waste management plan should include an on-going education and training programme on health care waste management developed for employees and, records of all training should be kept. The main aim of training is to create awareness on the health, safety and environmental management relating to waste generated in health care establishments and the impacts they have on people working around such waste.

From the interview with the administrators, most (83%) of them reported that their operational workers have knowledge on HCW management as they are trained every quarter on HRW management. Respondent 1 and 7's sentiments are shown in the following excerpt:

*“Yes, they are trained, and the file is kept safely, that also shows that even cleaners are trained, and they come back with the proofs (attends registers) that shows that they have attended the waste management training.” (Respondent 1)*

*“Yes, they are trained, there is a company that comes to train our workers on a yearly basis, mostly it trains nurses and cleaners.” (Respondent 7)*

However, out of 167 operational workers (doctors, nurses and cleaners) who participated in the study, 135 of them reported that they are trained, and 32 of them are yet to undergo training (Fig.4.3). Very few (17%) administrators stated that some of their employees were not trained. Sentiments proffered by respondent 5, 7 and 18 are shown in the following excerpts:

*“Not all of them are trained, because the service provider that trains specify the number of people they want for training, some operational workers even tend to forget what they have learnt during training and it is always few people at a time.” (Respondent 5)*

*“We have a problem that most of our workers do not want to go for training, I just force them, which is very hard.” (Respondent 7)*

*“Not all of them are trained, especially those who are still new, because these trainings are conducted by the district office, so there is time that they do this training and they call a specific number as the facility is huge, they can just say one or two, and they are trained on a quarterly basis.” (Respondent 18)*

Therefore, there is a possibility that some health care establishments are not complying with the Regulation due to lack of training.

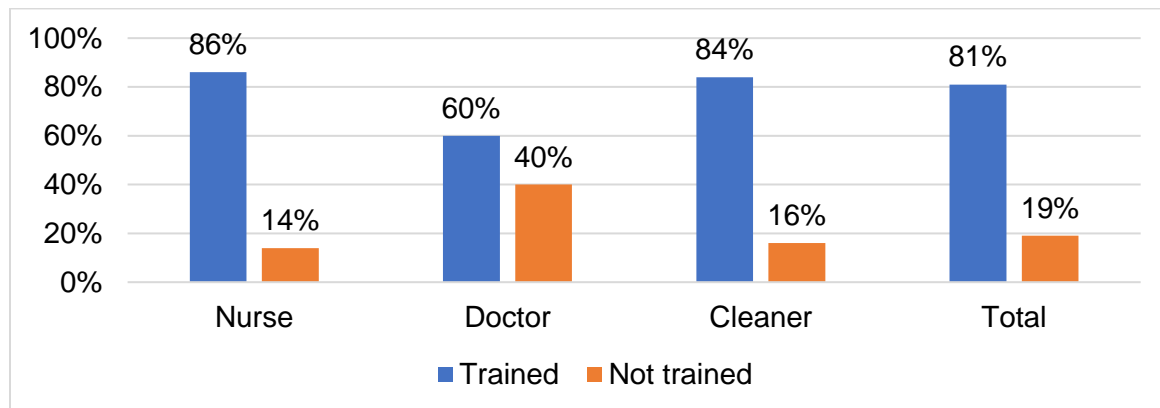


Figure 4-3: Respondents’ occupation and training of operational workers

Fig.4.3 presents the percentage of operational workers that are trained on HRW management in the health care establishments. The results show that 94 (86%) nurses are trained, followed by cleaners 26 (84%) and 15 (60%) doctors are trained. A total of 135 (81%) operational workers out of 167 were trained and 32 (19%) of them were not trained. However, 116 (86%) operational workers that are trained were found to be knowledgeable about HCRW management including

colour coding of waste containers, when answering the questions, 19 (14%) reported that they are trained but their response to the questionnaires shows that they are not acquainted with HCRW management. The findings also showed that 27 (84%) of them reported that they are not trained, and they have knowledge of HCRW management, and 5 (16%) respondents submitted that they are not trained, and do not have knowledge of HCRW management.

In the study by Makhura (2016) it was found that majority of health care operational workers have low level of knowledge on the management of health care waste generated due to lack of training, lack of knowledge on colour coding of the containers and the importance of segregation. Motlatla (2015) added that lack of training programmes by the service providers and health care establishment administrators or managers is one of the problems that that is detrimental to the management of HCRW. Since training is the source of knowledge, improved knowledge on the HCRW management can be done through regular training for all health care operational workers.

#### **4.5.2 Availability and use of personal protective gear**

According to the Regulation, for health care waste to be properly managed, all health care waste operational workers who manually handle untreated waste should have the necessary and appropriate protective gear such as protective gloves, overalls, boots, face masks, changeable laboratory coats or other appropriate personal clothing needed in the process of health care waste management. During the interview with the administrators, most (78% )of them reported that their operational workers have all necessary protective equipment and the records are kept, as also indicated by the respondent 1 in the extract below, whereas some (22%) of them showed that there is shortage of protective equipment, as the view that respondent 4 and 5 proffered shown in the following extracts:

*“Yes, they have those long gloves that they use when cleaning, we have aprons, we have the gloves that nurses use to take blood, the boots that the cleaners are given by the department, not so long I just from collecting the boots that the cleaner uses, we also have the googols that are used in maternity when there is deliverance of babies, face masks they are so many. ”*

**(Respondent 1)**

*“We have some, some run short sometimes, because of our delay to order.” (Respondent 4)*

“No, most of them don’t have boots and long-sleeved gowns, because the Department of Health fails to supply them due to financial problems.” **(Respondent 5)**

However, operational workers answered the questionnaire based on specific protective gear they have (Table 4.2).

Table 4-2: Proper use and availability of protective gear by the Operational Workers (OW)

Availability of protective clothing	Gloves	Face masks	Long-sleeved gowns	Plastic aprons	Boots	Total No. of OW
Doctors	22	18	10	11	4	<b>25</b>
Nurses	95	71	4	64	0	<b>109</b>
cleaners	25	11	11	25	15	<b>33</b>
<b>Total</b>	<b>85%</b>	<b>60%</b>	<b>15%</b>	<b>60%</b>	<b>11%</b>	<b>167</b>

Table 4.2 shows the percentage of operational workers that have necessary protective gear in the establishments. It shows that 85% of the operational workers had gloves, and 15% of them were found not using them because of shortage. It was also found that 60% of the operational workers have face masks and plastic aprons, however, some operational workers mostly from clinics reported that they have face masks and plastic aprons, but they were found not using them because of ignorance and lack of knowledge. Only 15% of the operational workers had long-sleeved gowns, with very few nurses having them. It was also found that only 11% of the operational workers had boots, of which none of the nurse were found with boots, very few doctors and most cleaners had them.

The results in this study show that some operational workers did not have the protective clothing at all, whereas some had them but not using them because of ignorance and lack of knowledge, as some mentioned that they do not wear them because of the weather condition. A study conducted by Hangulu and Olagoke (2016) revealed that despite that operational workers have received training on the use of personal protective equipment (PPE), some operational workers do not use them, some used their bare hands to handle HCW due to lack of knowledge and the shortage of gloves. Kumar *et al.* (2015) noted that health care operational workers are handling waste without using the impervious gloves and face masks and unaware of the potential hazard. Therefore, for the safety of health care operational workers, awareness on the risk or danger of

waste they are handling is important for operational workers to have an understanding on the necessity of using Personal Protective Equipment (PPE).

#### 4.5.3 Types of health care risk waste generated and their sources

According to The World Health Organization (WHO) (2014) and the regulation relating to health care waste in health care establishments (R.375 of 23 May 2014), health care waste can be classified into health care general waste (non-hazardous) and health care risk waste (hazardous). This study also confirmed that there are two types of health care waste generated, which are Health Care General Waste and Health Care Risk Waste (HCRW). Health Care General Waste was found to comprise of food leftovers, papers, plastics, and medical package boxes.

The study focused mainly on the HCRW, that included sharps and vials; infectious; anatomical/pathological; pharmaceutical and chemical waste; as well as radioactive waste (Fig. 4.4). The sources of waste were from hospitals, health centres and clinics in wards such as maternity, paediatric, surgical, chronic, medical ward, and consulting. It was also confirmed by previous studies that these types of HCRW are generated in almost all health care establishments globally (Motlatla, 2015; Kudoma, 2013; Vumase, 2009; Nemathaga, 2008).

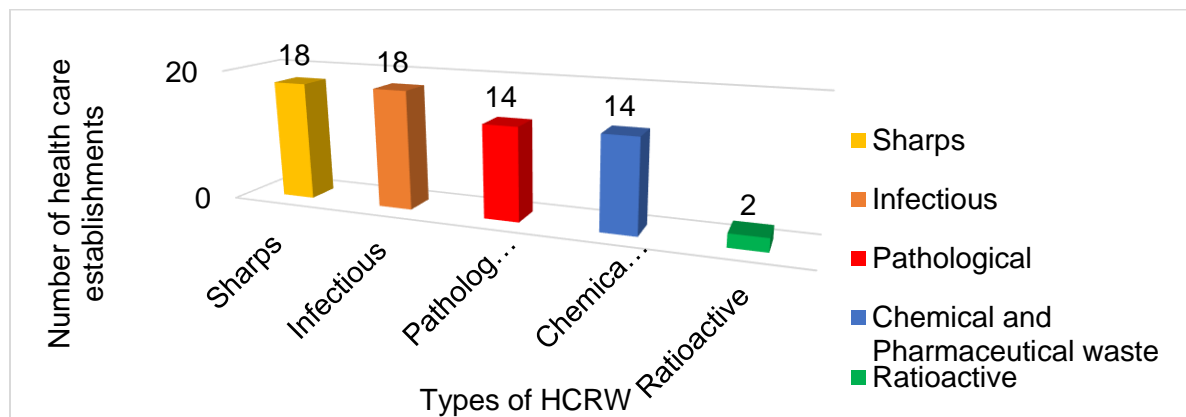


Figure 4-4: Types of HCRW generated in health care establishments in the study area.

Fig.4.4 shows the types of HCRW generated in health care establishments in the study, which indicate that sharps and infectious wastes (used gloves and bandages) are generated in the 18 investigated establishments, and the records are kept, which indicated sharps and infectious waste are the most generated HRCW (Table. 4.2), especially in hospitals and health centres.

Sharps waste were found to be most generated in medical, immunisation, and chronic wards where they receive more patients, however, in Hayani Psychiatric Special hospital it was found that more sharps are generated in forensic wards where there are many mentally disturbed patients. Ngole (2017) elucidated that sharps, especially needles are generated in the hospital in all medical wards and departments. The results from this study indicate that most of the infectious waste are generated in surgical and maternity wards, which concur with the results from the study conducted by Ngole (2017) and Reenen (2014) which stated that infectious waste was the most generated in maternity and theatre wards.

The results from this study show that if infectious and sharps are not properly handled, they have the potential to affect people's health and the environment, as Otto (2008) maintained that sharps and infectious waste have high potential for infection and injury than any other types of waste, whereas radioactive waste have less effect, since they are also hardly mixed with other waste and they are generated in small amount. To avoid risks (infection of diseases and impact on the environment) associated with improper handling of sharps and infectious as the most generated waste in almost all health care establishments, it is beneficial to manage or handle such waste properly.

Fourteen (14) health care establishments were found to be generating pathological waste mainly from maternity ward during birth, and the remaining 4 clinics do not have maternity delivery facilities, they transfer pregnant women to the nearest hospitals or health centres. It was also found that chemical and pharmaceutical wastes are generated in all hospitals and 11 clinics, because they order more than enough medicine, owing to failing to balance or estimate the community needs with the medicines during planning, so such medicine expire and end up as waste. The remaining clinics, however, do not generate such wastes, because they are always provided with enough medicine by the Department of Health and use them before they get expired. An administrator in Hayani Psychiatric Special hospital out of the interview conversation with the researcher stated that:

*"In this health care establishment, we have a system of transferring some medicine to other health establishments before such medicine expire, when we see that the medicines are more than enough". (Hayani Psychiatric Special Hospital administrator)*

In some clinics, however, there is frequent shortage of medicine. Two hospitals (Tshilidzini and Donal Fraiser) were found to be generating radioactive waste, whereas in Hayani hospital and





11% of them were not sure if their hospitals kept such records. Furthermore, the study also revealed that the remaining 33% of hospitals in North West, Northern Cape, and Mpumalanga province kept the records of the number of containers of waste generated in their hospitals. All the respondents from Gauteng and the Western Cape indicated that such records existed in their hospitals, however, it was found that in Free State, Limpopo, Eastern Cape, and KwaZulu-Natal hospitals no records are kept (Vumase, 2009).

#### **4.5.4 Segregation health care waste and knowledge of the health care workers**

The Regulation also states that all health care waste should be separated at the point of generation and be containerized to minimize the risk of contamination to human health and the environment. Kudoma (2013) and, Zikhathile and Atagana (2018) mentioned that it is the responsibility of waste generators such as doctors and nurses to segregate HCRW from the point of generation. This study maintains that segregation of waste at point of generation is critical to safe management of HCRW because it minimises the chances of infection and injury to the cleaners or persons who handle waste, and it also reduces the amount of waste to be incinerated. In this study, all 18 health care administrators interviewed posited that there is segregation of health care waste at the point of generation. However, it was noted that sometimes there is mixing of waste. The view that Respondent 9 proffered is shown in the following extract:

*“We do segregate at the point of generation, however, sometimes some nurses do mix mistakenly, due to work overload” (Respondent 9)*

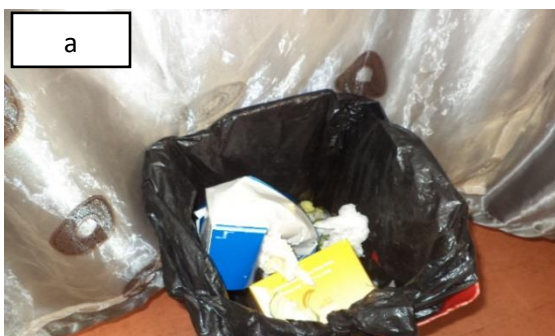
The study found that there is lack of knowledge and equipment for segregation of HCW including colour-coded containers, as it was confirmed that 4 (22%) of the investigated establishments mix health care general waste with health care risk waste, while (14) 78% are segregated properly. A study by Ngole (2017) reported that health care waste was not separated at source of generation because of lack of waste containers, but where they are available, some containers were not colour-coded, which leads to mixing up of the general and hazardous waste, this making all waste be hazardous. A study conducted in South African provinces by Vumase (2009) found that only a few hospitals in various provinces such as hospitals in Western Cape, Gauteng, and North West were regarded as adequate in terms of segregation of HCRW from general waste, while the rest were inadequate.

In this study mixing of health care general waste with HCRW such as infectious waste was mostly common in pediatric and maternity wards, as the operational workers are unable to conduct awareness on HCRW management to the patients (Plate 1). It was found that although sharps are supposed to be segregated in yellow container with a recognized sign, 8 (44%) investigated establishments were found mixing sharps such as needles with vials (Plate 2). However, some nurses stated that they mix waste because of work pressure with long queue of patients to be treated in the establishment, whereas, others noted that it is because of shortage of containers. In some establishments, it was found that when there is a shortage of specific containers, they labelled containers that are not for such type of waste for segregation, for example vials container labelled for needles. This often results in waste mixing as some staff stick to the colour coding.



**Plate 1:** Infectious waste mixed with general waste    **Plate 2:** Vials mixed with a sharp

It was further observed that almost half of infectious waste generated in the establishments was not segregated properly, as most of them were mixed with general waste such as papers (Plate 3). Mixing of papers and plastics with infectious waste was found to be most likely done by nurses and doctors in the process of treating patients. The study conducted by Yawson (2014) revealed that apart from 0.35% of sharps generated, segregation of health care waste in terms of infectious and non-infectious waste was hardly done at source.



Cotton with blood was found mix with general waste (a)



Papers mixed infectious waste (b)

**Plate 3:** Mixing of General waste with infectious waste

Regarding anatomical waste there was no mixing with other waste. Pharmaceutical waste which was expired drugs was found mixed with infectious waste in only one establishment. A study conducted in Northern Cape by Motlatla (2015), also supported that pharmaceutical and anatomical waste were correctly segregated in all hospitals, whereas sharps and infectious waste were correctly segregated by only 63.6% of the health care establishments.



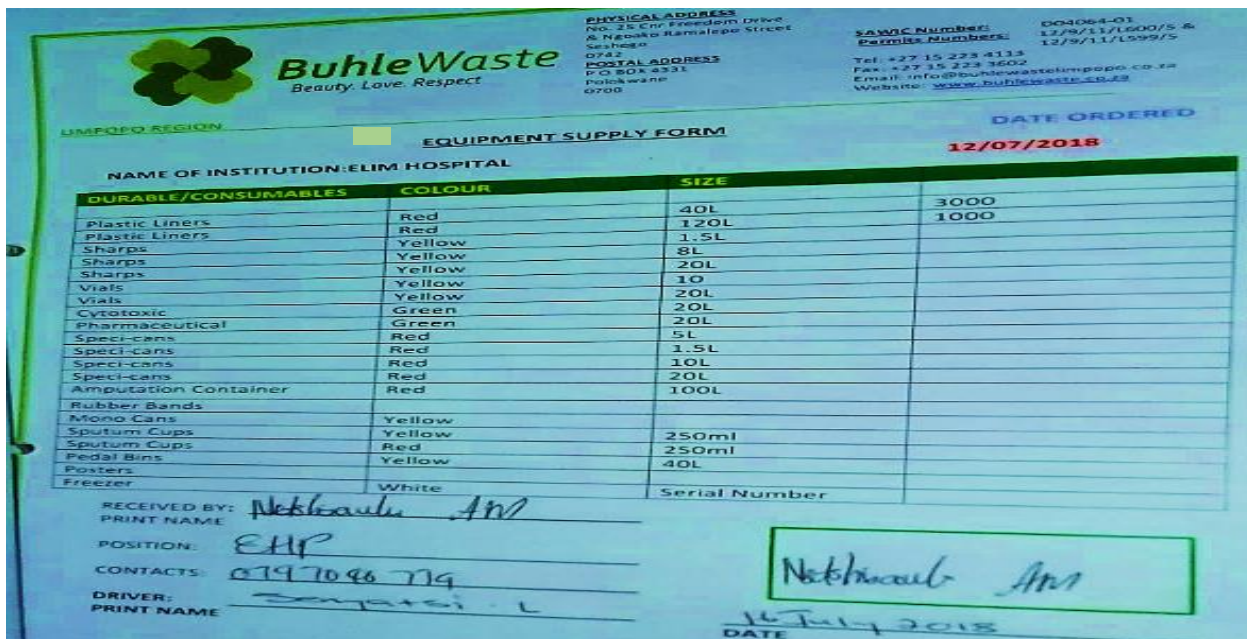
**Plate 4:** Anatomical waste (a) and Pharmaceutical waste (b) separated in their respective containers

Jewaskiewitz and Kudoma (2013) also stated that segregation of waste enables those who handle waste containers outside the wards to identify the kind of waste. This also helps waste to be treated and disposed appropriately. Failure to separate various HCRW waste according to the risk they pose, results in compound stream of waste which is very difficult to manage (Johnson *et al.*, 2013). Therefore, waste segregation at source is crucial in many ways, as it makes easier to identify the types of waste; reduces risks associated with injuries due to mixing; and makes it easier to treat and dispose of waste.

#### 4.5.5 Health care waste containerisation

For health care waste to be segregated, it requires containers and plastics supplied by the service provider responsible for collecting health care waste, however it is the responsibility of the person in charge of the health care waste management to order required equipment for waste containerisation (Table 4.4).

Table 4-4: Equipment's supply report



**BuhleWaste**  
Beauty. Love. Respect

PHYSICAL ADDRESS: No. 25 Cnr Freedom Drive & Nkomo Jumahele Street, Sehega, 0742  
POSTAL ADDRESS: PO BOX 431, Polokwane, 0700

SAWIC NUMBER: 004064-01  
Permit Numbers: 12/9/11/1600/S & 12/9/11/1599/S  
Tel: +27 15 223 4113  
Fax: +27 15 223 3602  
Email: info@buhlewaste Limpopo.co.za  
Website: www.buhlewaste.co.za

UMPOPO REGION:   EQUIPMENT SUPPLY FORM

NAME OF INSTITUTION: ELIM HOSPITAL

DATE ORDERED: 12/07/2018

DURABLE/CONSUMABLES	COLOUR	SIZE	
Plastic Liners	Red	40L	3000
Plastic Liners	Red	120L	1000
Sharps	Yellow	1.5L	
Sharps	Yellow	8L	
Sharps	Yellow	20L	
Vials	Yellow	10	
Vials	Yellow	20L	
Cytotoxic	Green	20L	
Pharmaceutical	Green	20L	
Speci-cans	Red	5L	
Speci-cans	Red	1.5L	
Speci-cans	Red	10L	
Speci-cans	Red	20L	
Amputation Container	Red	100L	
Rubber Bands			
Mono Cans	Yellow		
Sputum Cups	Yellow	250ml	
Sputum Cups	Red	250ml	
Pedal Bins	Yellow	40L	
Posters			
Freezer	White		
		Serial Number	

RECEIVED BY: Nkhembo AM  
PRINT NAME

POSITION: EHP

CONTACTS: 079 7096 779

DRIVER: Zampasi L  
PRINT NAME

Nkhembo AM  
DATE: 16 July 2018

Table 4.4 shows the types of equipment's supplied for HCW management in Thulamela health care establishments, which indicate that more containers supplied are yellow ones for vails and sharps, red containers and red plastics for infectious waste (Plate 5), very few green containers for pharmaceutical were supplied, which show that there are very few pharmaceutical wastes generated.



a) Containers and plastics for HCRW, and b) Containers for HCRW

**Plate 5:** HCRW containerisation equipment

### **Availability of proper health care waste bins**

During the interview some health care administrators reported that they have enough and proper HCRW containers. Other respondents proffered that they get faulty bins and return them back to the service provider. The proper health care waste bins were noted to be providing for effective waste management. However the faulty bins were detrimental to waste management. This was evidenced by the views of respondent 13, 4 and 7 indicated in the following quotations.

*“Yes, we have enough containers, there are no shortages.” (Respondent 13)*

*“Containers we have them but, sometimes we get faulty ones, and we don’t return them because they will also deliver late and we won’t be having another containers to use.” (Respondent 4)*

*“Yes, we once received faulty bins that were not closing so, we returned them, and they replaced them with proper ones.” (Respondent 7)*

The observation also confirms that in some establishments some waste bins were not in the proper state as reported by the administrators and illustrated in Figure 4.5.

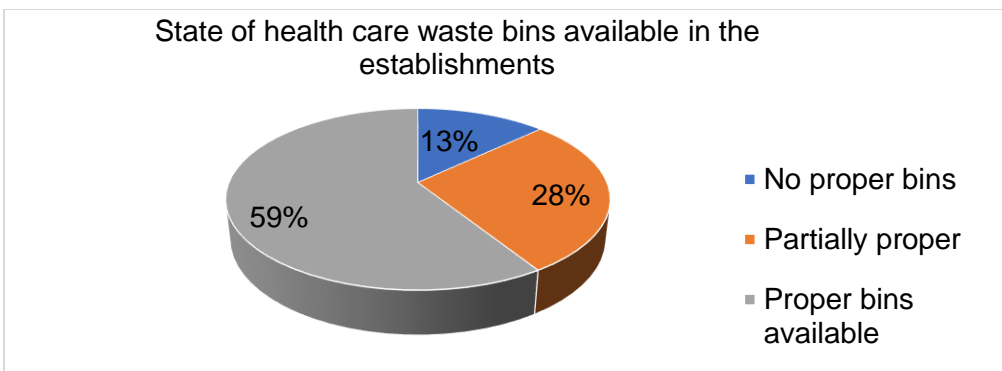


Figure 4.5: Availability of proper waste bins in the study

It was observed that 13% of health care establishments do not have the complete relevant and proper waste bins for all types of health care waste, but health care establishments improvise by using their own baskets not the ones provided by the service provider (Plate 6), an improvised vials container used for sharps were also found not closing (Plate 7). Twenty-eight percent (28%) establishments in the study were found with partially proper bins, either damaged, without lids or pedal not working. Most sharps bins were found not closing properly (Plate 7 and 8a), and infectious waste bins pedals were not working, they were using hands to open and close them. During observation in the other establishment, there was an incident where sharps bin that were on top of the desk accidentally fell and all vials scattered all over, because of bins that were not closed properly (faulty bins) exposing both the patients and personnel to risk (Plates 8b). More than half (59%) of the establishments were found with waste bins in a proper condition.



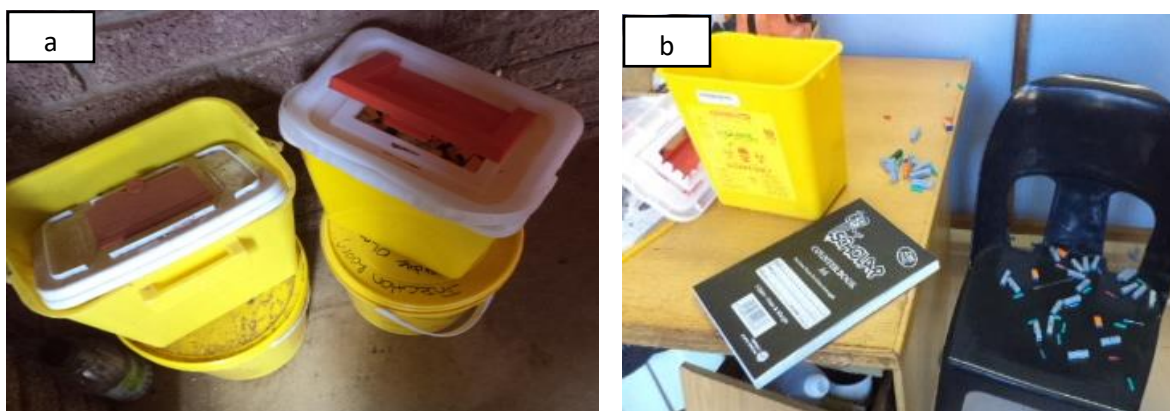
**Plate 6:** improvised basket for general waste



**Plate 7:** Faulty and improvised container

In one of the establishments in the study, unique sharps waste containers were found interesting and better to use, though they only contain few sharps wastes. It seems to be easy to close and

once it is closed cannot be opened in the establishment, which decreases the chances of being injured (Plate 9).



**Plate 8:** Faulty sharps containers (a) Faulty vials container which accidentally fell (b)



**Plate 9:** Unique sharp waste container

Manzi (2014) also revealed that shortage of health care waste bins resulted in the improper disposal of waste and non-compliance with local or national waste management policies. Therefore, it is the responsibility of the heads in the establishment to ensure that there a supply of enough and proper containers for good management of health care waste.

#### **4.5.6 Temporary or central storage of health care risk waste**

Dawar (2017) postulated that proper temporary storage is important for the safe storage of HCRW to protect it from the access of unauthorised persons and stray animals which minimizes the health risk and environmental pollution. In this study, most (78%) of the interviewed administrators indicated that there is temporary storage for HCRW, the remaining respondents



from clinics indicated that there is no temporary storage in their health care establishments. This is evidenced by the sentiments of respondent 13 and 7 shown in the following extract.

*“We have a proper standard storage that is newly built last year, because previous years we were using a storage that was just improvised, that was not meeting the standards for waste management.” (Respondent 7)*

*“We don’t really have specific storage, the department have been promising us one, now we are just storing the waste at an old toilet that we no longer use it.” (Respondent 13)*

However, it was observed that what the administrators stated was different, as most of the health care establishments were found not to have proper temporary central storage, which is completely secured, with enough space (Fig.4.6).

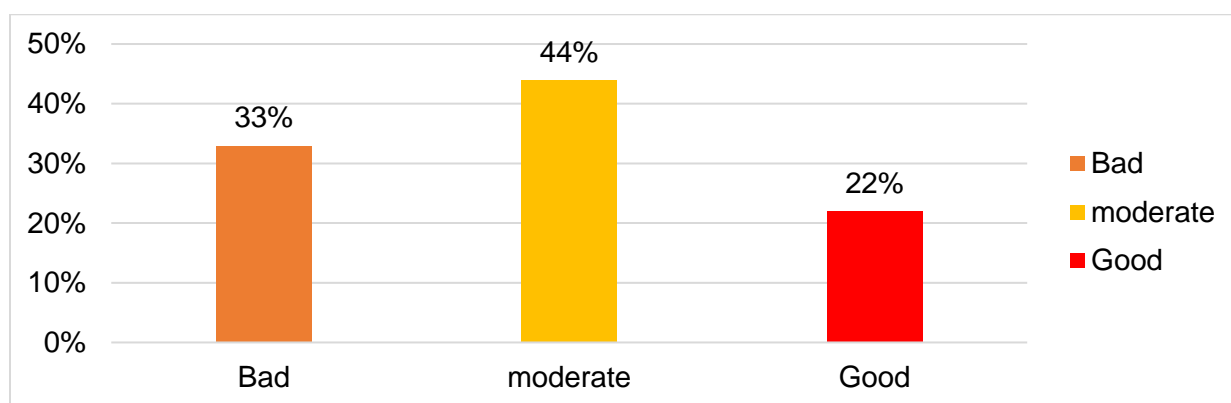


Figure 4-6: Conditions of temporary storage for HCRW in investigated establishments

According to the Regulation, good HCRW management includes proper temporary storage, which is secured, visually displayed with hazard sign, have space for storage of empty containers, locked, easy to access by authorised people only, and protected from direct sunlight. Figure 4.6 shows that 6 (33%) health care establishments, mainly clinics in villages do not have proper storage at all, so they just improvise by using places such as toilets or garden equipment storage (Plate 11). whereas some clinics’ storages are also not protected from sunlight and rain (plate10). A similar study conducted by Motlatla (2015) in Northern Cape also indicated that 7 (63.6%) of hospitals had temporary storage for health care waste, however the location and nature of the storage areas differed from one hospital to the other. It was found that some

hospitals were using toilets as a temporary storage area, whereas others were using sluice rooms as a storage for HCW.



**Plate 10:** Improper temporary storage, not protected from sunlight and rain.



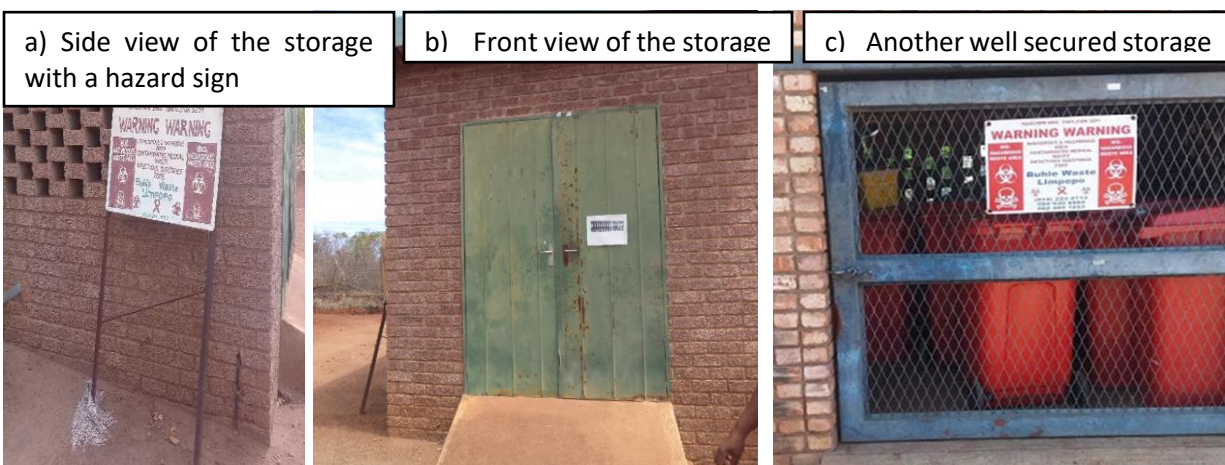
**Plate 11:** Garden equipment's storage compromised to be temporary storage

In this study, it was found that 8 (44%) establishments (in one hospital and 7clinics) have temporary storage, but without lockers (Plate 12). A study conducted in hospitals in Vhembe District confirmed that one of the hospitals in Thulamela Local Municipality did not have a proper temporary storage, as it did not have a locker, hence this could be dangerous considering the type of waste stored (Nemathanga *et al.*, 2008).



**Plate 12:** Temporary storage with sufficient space, but without a lock

Only 4 (22%) of the health care establishments (2 clinics and 2 hospitals) were found to be having proper temporary storage with proper structure, lockers and out of bound to unauthorized people (Plate 13). Therefore, compliance regarding temporary storage is still very low within Thulamela Local Municipality health care establishments.



**Plate 13:** Proper storage facilities for HCRW management

Studies conducted within South African provinces also revealed that most of the hospitals that are in rural areas had temporary storage, whereas all hospitals in urban areas had temporary storages (Reenen, 2014 and Raphela, 2014). Therefore, it is the responsibility of heads of the establishments and department to ensure that there is a proper construction of the temporary storage, to avoid putting the health of people at risk of air pollution, which can also cause infections of diseases through insects such as mosquitoes.

#### **4.5.7 Weighing of the health care risk waste**

According to the Regulation, before the health care risk wastes generated are transported from the establishment, they must be weighed. As already mentioned, all 18 health care establishments in this study were found with records for HCRW generated and collected by the service provider (Table 4.2), which also indicates that they weigh such waste before collection. However, only one clinic (5%) was not found with some records missing, though they say weighing was done by the service provider. Kudoma (2013) also noted that health care waste generated in the Botswana was weighed before collection to compute the generation rates and was followed through the various management practices to the final disposal. However, administrators in the establishment reported do not keep records of waste generated, but only check if health care waste is collected from every ward.

In the study conducted by Vumase (2009) within South African provinces, found that 19% of the respondents assumed that there were scales to weigh health care waste generated before the final disposal, however, the results showed that most of the hospitals in the study did not have such scales and many respondents state that they have no reason to weigh the waste or to keep adequate records for waste generated. It therefore shows that health care operational workers in this study are complying with the regulation as it states that there should be weighing of waste generated and keeping records.

#### **4.5.8 Health care risk waste collection and transportation by accredited company**

The Regulation noted that HCRW should be transported to the temporary storage on a daily basis and collection and transportation from the temporary should be done regularly based on the amount of HCRW generated in a week. The results from data collected show that the frequency of HCRW collection and transportation by the accredited companies varies from one establishment to the other (Table 4.5). In this study, it was found that HCRW is collected daily in all health care establishments from the wards to the temporary storage and when it comes to collection from the temporary storage to outside the establishment, the frequency of collection differs depending on the size of the establishment.

Table 4-5: Collection and transportation of HCRW from temporary storage facilities

Frequency of HCRW collection	Number of establishments	Percent
Daily	0	0%
Twice a week	3	17%
Fortnight	11	61%
Monthly	1	6%
Twice a month	1	6%
Not reliable	2	10%
Total	18	100%

Table 4.5 indicated that in most (61%) health care establishments (2 hospitals and 9 clinics) HCRW was collected fortnight, followed by 17% of the clinics where collections were done twice a week. Respondent 6 and 18's expressions are shown in the following quotations.

*“They come and collect fortnight, on Wednesdays” (Respondent 6)*

*The service provider come to collect risk waste. They come twice a week and where necessary, if we have overload, we call them and come to collect.” (Respondent 18)*

The findings showed that 10% of the establishments (one hospital and one clinic) showed non-reliable collection schedule, indicating that collection takes place depending on the need. None of the establishments were found collecting HCRW from the temporary storage daily.

Hangulu and Olagoke (2016) established that most of health care facilities in South African provinces have a regular collection of HCRW by the private companies, as they were found with a fixed schedule collection based on amount of waste generated in a week. Kudoma (2015) on a study conducted in Botswana showed that most of the health care risk waste (40.9%) are collected daily and 39.8% are collected twice a day with 5.4% collected weekly. In this study results showed that HCRW collection still need an improvement of regular collections to avoid accumulation of waste that may even cause air pollution to the environment and affect people's health.

When HCRW generated have reached a maximum limit in the bins, they should be collected and transported from wards to the temporary storage. The transportation of such waste must be done with designated trolleys as indicated by the Regulation. In this study, it was found that collection and transportations vary from one establishment to another, as in some

establishments consistency on collection and transportation was found and others were not consistent (Fig. 4.7).

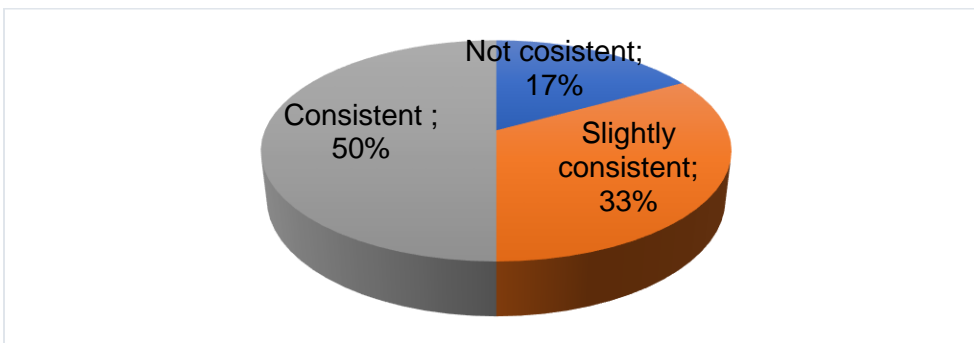


Figure 4-7: Consistency for proper collection and transportation of HCRW

Fig.4.7 shows that in 3(17%) establishment which were clinics, waste generated was not being collected in time, hence the bins were being filled up, for example full sharps bins were found to exceed the limit and not closed (Plate 14), which shows non-compliance with the regulation. While 6 (33%) of the establishments were found with their bins closed when they reached the limits, but they were not collected and transported to the storage immediately and most of HCRW generated were found to be transported by cleaners using their hands, and some were found using medication trolley (Plate 16). The respondents also noted that some use wheelbarrows because of lack of dedicated trolleys or any form of transport. A study conducted by Vumase (2009) found that 89% of the respondents in South Africa provinces showed that dedicated trolleys were not present in their hospitals. In this study 9 (50%) establishments were found collecting and transporting HCRW properly in time, using the dedicated trolleys that are used only for transporting HCRW (Plate 15).

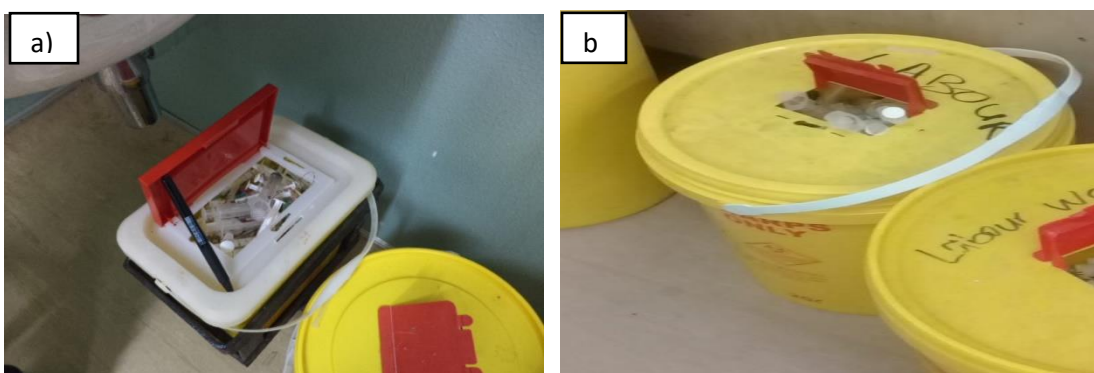


Plate 14: a) Full sharps container and b) Another full sharp container



**Plate 15:** Dedicated trolley for HCRW transportation to the temporary storage



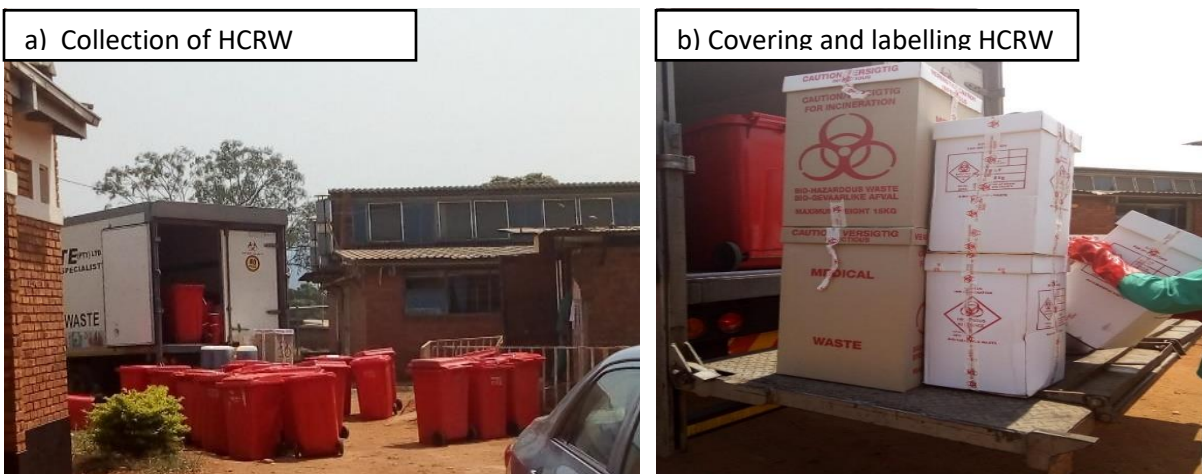
**Plate 16:** Medication trolley used for transporting HCRW

Vumase (2009) also mentioned that transportation of health care waste within the health establishment should be done through the use of trolleys which are not used for any other purpose, and out of the establishments by appropriate vehicles marked with biohazard symbol. This study found that the schedule of waste collected from the wards to the temporary storage area within the establishments and out of the temporary storage area to the final treatment and disposal site is dependent on the size of the establishment, number of available equipment, facilities and operational workers. It is therefore the responsibility of health care waste officer to ensure that the service provider supplies bins or containers for HCRW that are in proper condition, that are not faulty, and the transportation of such waste is done with a dedicated trolley only use to transportation of HCRW.

Insa *et al.* (2010) pointed out that health care waste must be transported from the source of waste generation to the place where it will be treated and disposed of, and collection and transportation of health care waste must be carried out by trained personnel from authorized waste collection companies. Kudoma (2013) stated that where health care waste is transported inside the establishment, all containers should be covered and labelled as being hazard according to the specifications of WHO, which is also specified in the Regulation. In this study, very few administrators stated that they are not sure if the service provider does the labelling and covering when collecting, as indicated by the Respondent 18's sentiments in the following extract.

*"No, I am not sure, I haven't seen them labelling and covering the containers when they come to collect."* (**Respondent 18**)

Most (89%) of the respondents submitted that they do labelling and covering of containers is in their establishments. Plate 17 shows how the service provider labelling and covering HCRW to be transported from the temporary storage outside the establishment for treatment and disposal, which shows that most health care establishments in the study were found to be complying with the regulation and WHO specification for adequate management of such waste.



**Plate 17:** a) Collection of HCRW, and b) Covering and labelling of HCRW

#### 4.5.9 Treatment and disposal of health care risk waste

All health care establishments administrators and health care operational workers in the study showed that they do not dispose or treat any waste in the establishments, they reported that all HCRW are treated and disposed by the service provider that collect and transport outside the establishment. General waste generated are collected, treated and disposed by the municipality. Many health care establishments indicated that they used to incinerate their HCRW inside their establishments, but no longer use it because the process is harmful to the environment and people's health. The views of Respondent 13 are indicated in the following excerpt:

*“We used to treat using gas machine but now service provider come and collect, because the Department of Health no longer allow us to incinerate, as the process can be more dangerous because of having toxic waste and have more chances of emitting hazardous gases, which can also pose serious threats to both the health and environment.” (Respondent 13)*



A study conducted by Vumase (2009) revealed that there is no reliability in the use of HCRW treatment system by hospitals in the provinces, as Gauteng and Western Cape were found using reusable containers, and in Mpumalanga all the hospitals in the study were found using incinerators. The study conducted in two hospitals in Vhembe District showed that they used to treat HCRW inside the establishments, it indicted that pathological waste generated was incinerated, infectious used to be autoclaved, sharps, chemicals and general waste used to be sent to the landfill. However, it is recommended that incinerators should be stopped immediately as they are a source of health and environmental hazard (Nemathaga *at al.*, 2008). According to Ngole (2017) recently the most common method of health care waste disposal is off-site treatment, where waste is taken out of the establishment for treatment and disposal and approximately 90% of health care waste generated in the establishment are off-site treated and disposed. Therefore, off-site treatment and disposal are important in all establishments globally for the safety and health of people around the establishment.

#### 4.4.8.1 Records for proof of treatment and disposal of health care risk waste

After HCRW has been transported out the health care establishments for treatment and disposal, the service providers are supposed to bring back the proof or certificate indicating where HCRW was treated and disposed. In this study it was found that some establishments had records of treatment and disposal of HCRW generated (Fig.4.8)

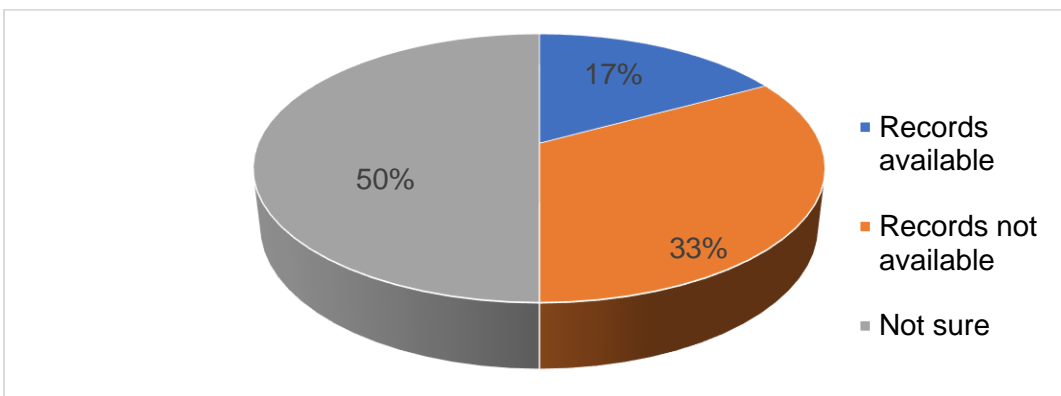


Figure 4-8: Records of HCRW treatment and disposal availability

Fig.4.8 shows the percentage of health care establishments administrators who reported that they get records for proof of HCRW treatment and disposal after HCRW was been collected out of the health care establishments. It was found that only 3 (17%) respondents reported that they

receive a proof of treatment and disposal from the service provider that collected the waste (Fig.4.9), 6 (33%) of them show that they do not receive proof, whereas 9 (50%) of the respondents from clinics show that they are not sure or do not know if their health establishments get a proof of disposal and treatment, which means they do not follow up as heads of the health care establishment. Respondent 5, 4, and 6's sentiments are shown in the following extracts.

*“Yes, we do receive the records, as a proof from the service provider.” (Respondent 5)*

*“No, I am not sure, I haven't seen, I think the district is the one that receive it “(Respondent 4)*

*“No, I didn't know we were supposed to get it, thank you, I will do the follow up.” (Respondent 6)*

Therefore, the results show that people in charge of the health care establishments do not comply with the regulation of getting a proof of how waste from their establishments has been treated and disposed.

According to the observations made by the researcher, it was found that 72% of the health care establishments were found not having proof of treatment and disposal (Fig. 4.8), whereas only 28% of the establishments in the study were found with the records of HCRW treatment and disposal. This shows that compliance regarding treatment and disposal is still lacking in most health care establishments. Fig.4.9 shows certificates of safe disposal given back to the establishment by the service providers. Figure 4.9 also shows when such waste was treated and disposed, the types and amount of waste treated and disposed. It shows that HCRW was incinerated, the name of the incinerator and designation of the person.

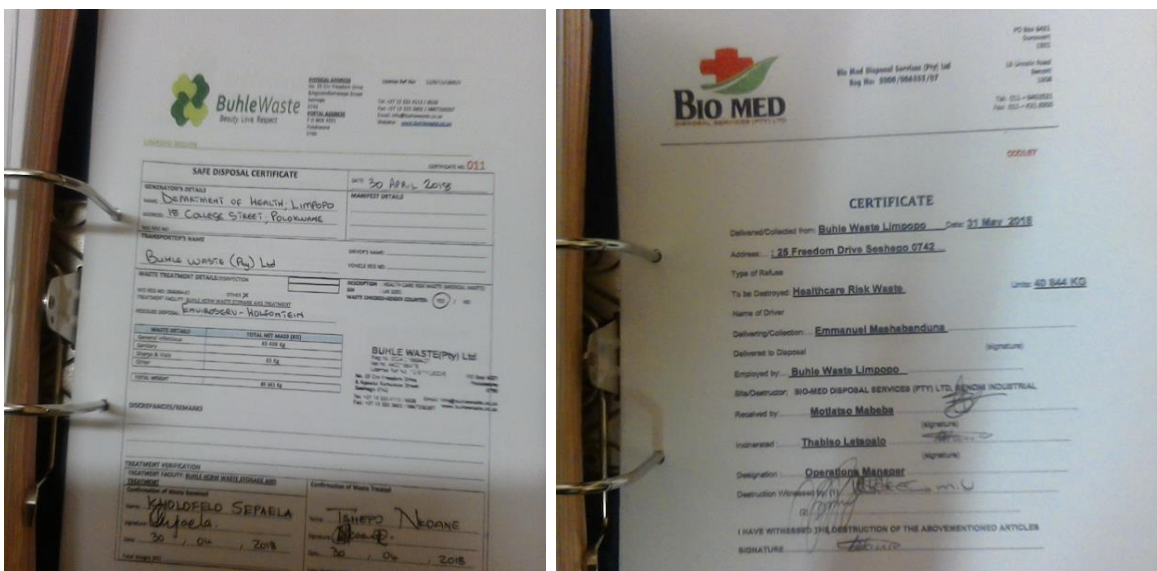


Figure 4-9: Certificates of safe disposal

According to Kudoma (2013) incineration is considered the most commonly technology that reduces the amount of health care waste generated. It is considered the golden standard treatment method, though it leaves behind toxic ash and noxious gases that can cause harmful air pollutants (Azmal et al., 2014). The regulation specified, as already stated in the literature that health care waste treatment and disposal should follow the requirements as specified in the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), and the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) and any amendments thereof.

Jewaskiewitz (2013) and Andrea (2018) acknowledged that HCRW disposal is costly and creates contamination risk or affecting people's health and the environment since much of HCRW contains hazardous materials such as body fluids, mercury, and other toxic substances. The lack of proper HCW management treatment and disposal procedures and awareness by healthcare operational workers leads to health care establishments becoming epicentres of spreading disease rather than working toward eliminating those diseases (Sengodan, 2014). Therefore, though they no longer treat or dispose health care waste inside the establishment, it is the responsibility of a person in charge of the health care waste management to ensure that the place where they treat, and dispose is not close to residential areas and safe for both people and the environment as much as possible.

#### 4.6 Summary of level of compliance with health care risk waste management regulation

In order to find out the level of compliance with the HCRW management regulation (R. 375 of 23 May 2014), there are indicators that were identified from the regulation. During the interview most of the administrators indicated that their compliance level is good, but not excellent as operational workers are aware of the policy for health care waste management, and the policy is reviewed after 3 years. The results also showed that sometimes they make mistakes in handling waste, and they do not have temporary storage for HCRW. The sentiments of respondent 1, 13, 3, and 7 are shown in the following extracts.

*“Our compliance level is excellent. So, you do not mix even accidentally? No, we don’t mix, because we get assessed by the department, we have never had any reporting of mixing after the assessment. Maybe it is because we also have a person assigned for checking that, if the person is not around, I move around all cubicle containers checking if there was a mixing mistake.” (Respondent 1)*

*“It is reviewed by the district then give us. It is reviewed after 3 years, or when there are amendments or occurrence that need something to be changed.” (Respondent 13)*

*“Operational workers know the policy, they are very aware, and it is accessible to everyone because each and every month we have something called ideal clinic realization status that we update every month, and that is done randomly to show all nurses the policy.” (Respondent 3)*

*“The compliance is good, not excellent, because they are still mixing waste and we don’t have a proper storage.” (Respondent 7)*

The indicators of compliance that were also identified and checked in study included health care waste management plans; health care management team and committee members;

identification, labelling and segregation of HCRW; HCRW storage; collection and transportation; treatment and disposal (Fig.4.10).

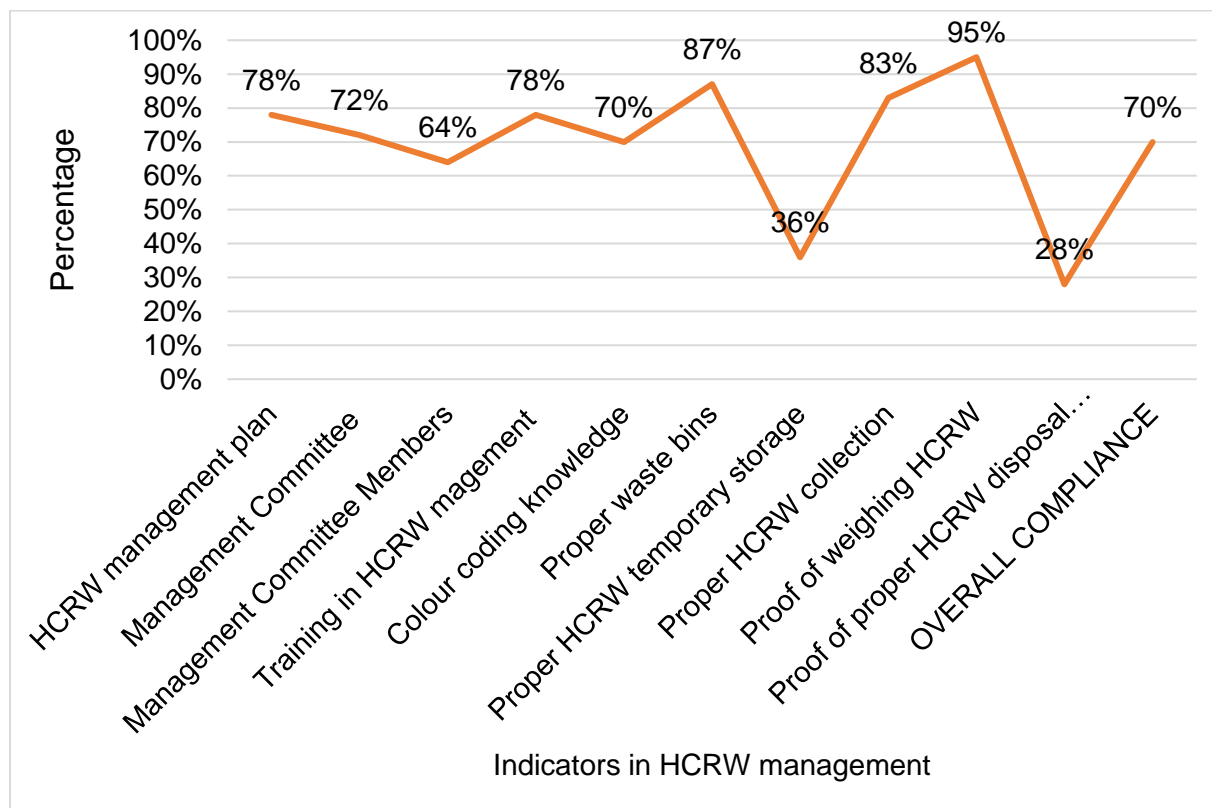


Figure 4-10: The level of compliance with the regulation

The level of compliance first indicator, health care waste management plans was found to be 78%, which means that 22% of the health care establishments were found not to be complying with the regulation, indicating that they do not have a management plan. The second indicator was health care management committee and committee members. The results showed that 72% of the establishments are complying, they do have a management committee and 64% found the committee members, which showed that some of the establishments have the committee, but they do not have the relevant members that should be in the committee. In this study shortage of committee members was found to be an influence in poor management of HCRW, for example some establishments did not have health care waste officers, they just appoint any nurse to do the work for a day, it was very likely that no one was appointed to be a HCR officer for the day which means that no one could monitor proper segregation, containerization, intermediate storage, internal transport and collection and to provide information on HCRW

policies and other legislative matters. Therefore, lack of committee members affects the process of HCRW management and results in poor compliance.

The third indicator according to the regulation, in management of health care waste there should be training programmes for all employees in health care waste management. In this study it was found that 81% of the operation workers were trained, however 70% of the establishments were found without knowledge in colour-coding and 78% of the establishments were segregating health care waste properly, which means 22% of them were not segregating properly. There was mixing of different categories of HCRW, and general waste as already mentioned under 4.5.4 subtopic. When it comes to containerization which is part of the third indicator, 87% of the health care establishments were found to be complying, however out of 87%, 28% from those establishments had partially proper bins and 59% had proper bins, 13% of them were having faulty containers (Plate 7 and 8).

The lowest level of compliance was the fourth indicator, temporary storage room with 36% of compliance, which means 64% of the health care establishments do not have proper storage. Most establishments reported that it is the responsibility of the Department of Health to ensure proper central storage. They do not have a proper storage as already shown on 4.5.6.

The last indicator which includes collection, transportation, treatment and disposal, it was found that 83% of the establishments were having proper health care waste collection which include labelling and covering (Plate 17), whereas 17% were not complying, in some establishments collections were not in time and some were not using designated trolleys for transportation (Plate 16). After transportation the regulation stated that there should be weighing of waste collected, and it was found that 95% (highest compliance) of the establishments were weighing and had records like the one indicated in Table 4.3, and 5% of the establishments were found not having some records on the weighing of waste collected. Since no health care establishment was found disposing and treating waste inside the establishment, it was found that only 28% of the establishments were having records of proper treatment and disposal of waste collected and transported outside the establishments, which means 72% of them were not having such records of proper treatment and disposal.

The overall level of compliance with the health care risk waste regulation was found to be 70%, which is considered not satisfactory for this type of waste. Some improper handling was also noted in this study as indicated in subtopic 4.7, which confirms poor management of health care

waste and non-compliance in some health care establishments. Andrea (2018) reported that the primary barriers to obeying to the regulatory standards for HCRW management included the transportation and disposal to treatment facility (Ali *et al.*, 2017 and Anozie *et al.*, 2017 and Njue *et al.*, 2015)

#### **4.7 Challenges faced on health care risk waste management and compliance with the regulation**

Although there are legislations for health care waste management in place it seems like there are still some challenges which causes improper management of HCRW. The Regulation No. 375 of May 2014, also emphasized that no health establishment should manage health care waste other than in accordance to the Regulation or in a manner that poses a risk or hazard to human and the environment, but there are still some challenges that are also caused by non-compliance with the regulation, such challenges are as follows:

- **Policy unawareness**

Policy for health care waste management was found to be in all investigated establishments in the study, some (11%) of the administrators indicated that they are not aware of the objectives of the policy (section 4.2.2). When the administrator or the person in charge of the establishment is not aware of everything on the policy it is an indication of non-compliance, which also means that even the operational workers of the establishment may not be aware of the objectives and not complying, since the policy is the one that gives the guidelines on how to manage waste in the establishment. Therefore, being unaware of the policy is a problem that may lead to improper management of health care waste. The respondents in this study proffered that despite the availability of the policy, some of them are not aware of some critical aspects of the policy. This ignorance is detrimental to the regulation compliance in health facilities. This is evidenced by the sentiments shared by respondent 3 and 4 in the following extracts.

“I know that the policy for health waste management is there in this facility, I am just not sure about the objectives of it.” **(Respondent 3)**

“Sadly, to be honest I don’t really know the objectives.” **(Respondent 4)**

- **Lack of training**

Nineteen percent of the operational workers stated that they are not trained, which resulted in lack of knowledge on the management of HCRW (segregation to the disposal). Regular training was also found to be a challenge, as it was pointed out that most cases service providers that trains specify the number of people, they want for training due to large number of health care establishments that they cover in Limpopo Province, which also shows a poor planning by the service provider and the Department of Health. So, increase in awareness and regular training will improve management of HCRW and that will be a form of compliance with the regulation.

- **Shortage of Personal Protective equipment**

Most health care administrators (78%) reported that though it is their responsibility to make sure that everything is under control, they have a challenge of shortage of protective clothing, due to the Department of Health's failure to supply enough, whereas in some establishments they have them, but some worker fail to use them as a result of lack of knowledge and ignorance. Kumar *et al.* (2015) reported that the most significant issue to proper HCRW handling at their establishment was due to waste handlers lack compliance with wearing appropriate PPE because of lacking knowledge on the importance of using them.

- **Storage containers for segregation**

Some respondents (44%) reported a shortage of bins and plastic bags, as a result of failure to place orders in time. Kumar *et al.* (2015) stated the lack of discrete HCRW bins to separate infectious from non-infectious waste leads to inadequate operational workers' safety. In this study, it was also found that 15% of the establishments have a problem of delays in collection of waste generated, which leads to full waste bins that also causes air pollution and mosquitos and 5% have a problem of faulty containers, especially on sharps containers not closing properly. A study conducted in South African provinces found that 92% of the respondents reported a shortage of the containers that affected almost all the hospitals and only 0, 3% of the respondents reported that they did not know if their hospitals experience a shortage in waste containers (Raphela, 2014). Therefore, it is the responsibility of the health care waste officer to ensure containers that are also in good condition are ordered in time.



- **Lack of dedicated trolleys and regular collection and transportation to the temporary storage**

Most of the health care establishments in the study were found with a challenge of lacking dedicated trolleys for transporting HCRW, which forces most collectors from the wards and from the temporary storage to use their hands to transport, and some using wheelbarrows, which is an indication of non-compliance with the regulation. In some establishments, delays on collection from the temporary storage, with a very limited storage space was also reported as a problem.

- **Temporary central storage**

In the study, it was found that most establishments are facing a problem of storage, as 14 (78%) respondents who are administrators and health care operational workers reported that they have lack temporarily storage room for HCRW. Some even noted that the Department of Health had promised to construct storage rooms some years back, but nothing is happening. Some noted that storage rooms are there, but it does not have enough space to store all the wastes generated in a week. The study conducted by Nemathaga *et al.* (2008) also noted the shortage of proper storage in Vhembe District in one of the hospitals Thulamela Local Municipality. Though the study was conducted several years ago, it seems like there is no much changes in the storage, and there is still non-compliance with the regulation so the establishment should pay more attention on that.

- **Improper handling of health care waste**

Improper management of waste was also found to be a problem in the study as reported by 16% of the respondents due to some reasons such as the busyness of the establishment which can cause mixing of waste, lack of training about HCRW management, especially new staff, also staff attitude towards the management of waste, which makes them to be ignorant and handle waste incorrectly. Plate 18 and 19 revealed that 38% of the health care operational workers in Thulamela Local Municipality's level of knowledge does not correlate with their practice in health care waste management. Plate 18 shows the sharps that were improperly handled, some nurses confirmed that such improper management is due to the busyness of the establishment, whereas some cleaners stated that it is because of negative attitude towards management and ward attenders. Cleaners or ward attenders also reported needle pricks as a result of poor segregation.



**Plate 18:** Improper handling of sharps

Motlatla (2015) also found that needle pricks are because of sharps containers shortages and inaccessibility by health care operational workers. Kumar *et al.*, (2015) reported that waste handlers or cleaners are the most vulnerable among health care operational workers to become infected by infectious waste due to improper management practices and improper precautions taken by waste generators such as doctors and nurses. Plate 18 shows general waste which was found discarded poorly at the back of the establishment premises, it was also found that such waste was mixed with some infectious waste.



**Plate 19:** Improper handling of health care general waste in one of the hospitals in the study

Intravenous therapy (IV) bag that was found poorly discarded around the health care establishment, which shows improper handling of infectious waste (Plate 20). Lack of suitable training and communication relating to the of infectious waste and its proper handling, and weak supervision and monitoring of HCRW.



**Plate 20:** Improper handling of infectious waste in one of the hospitals in Thulamela Local Municipality

A similar study conducted in George Masebe hospital, Waterberg District, Limpopo province, also found that though 44.3% of the health care operational workers had knowledge, 52, 5% had no practice in place, it was also concluded that there was no relationship between knowledge and practice of medical waste management (Malebatja, 2016). Hence, more education with implementation or practice is required to reduce the improper disposal of health care waste.

### Chapter summary

In this study level of compliance was found to be above 70% which is good for the management of health care risk waste. However, since there are still more challenges that cause improper management and non-compliance with the regulation, there is a need for the health care establishments to improve their level of compliance and reduce the challenges, from reducing mixing of waste, having proper waste bins, proper storage and have proper handling of health care risk waste.

## CHAPTER 5 : CONCLUSIONS AND RECOMMENDATIONS

### Introduction

This study was conducted to assess the level of compliance with the *regulation relating health care waste management in health care establishments (R.375 of May 2014)* in Thulamela health care establishments. This chapter presents the conclusion of the research finding for each objective of the study. The recommendations are also presented in relation to the results and the objectives of the study, with a focus on improving the compliance with health care waste management regulation. Lastly, the study presented the suggestions for areas for further research.

### 5.1 Conclusions of research findings

- **Types of Health Care Risk Waste (HCRW) generated in the health care establishments in Thulamela local Municipality**

It was found that types of HCRW generated in the study include sharps, vials, infectious, anatomical/pathological, pharmaceutical waste and radioactive waste. It was also found that most generated waste is sharps and infectious waste, and the least waste generated is chemical/pharmaceutical waste, pathological waste and radioactive waste. The study concluded that the same types of HCRW generated in Thulamela are same HCRW generated in health care establishments in most of part the world, however, the size of the healthcare establishment determines the amount of waste generated.

- **Level of knowledge of operational workers regarding HCRW management in Thulamela Local Municipality health care establishments**

The results from this study revealed that 81% of the health care establishments trained operational worker's regularly, 78% of operational workers segregate health care waste properly and 92 % of them are aware of the consequences of improper management of HCRW. It was also revealed that 72% of operational are trained and knowledgeable. Therefore, the study concluded that operational workers may be trained but still show that they have no knowledge, they can also be trained and knowledgeable about the proper management and the consequences of improper management of healthcare waste, but still do not segregate or manage waste properly.

- **Health care establishments administrators and operational workers' compliance with the regulation regarding HCRW management in Municipality**

The study focused on the level of compliance with the regulation, which is also described as a policy in health care establishments of the study. It was found that all health care establishments have health care waste management policy in place, however some establishments did not have a management plan. Therefore, establishments with absence of health care waste management are not complying with the first step of regulation compliance. Fig.4.10 in the previous chapter also showed that the lowest level of compliance with the regulation was on the availability of proper temporary central storage at 36%, and the compliance with proof of proper and safe treatment and disposal at 24%, which shows that most establishments do not receive a certificate of disposal from the service provider after collection (Fig.4.9) . The highest (95%) compliance was found to be on keeping monthly records for HCRW generated which was shown by the records kept for weighing HCRW (Table 4.2). The overall compliance level of the health care establishments in the study were found to be 70%, which conclude that the level of compliance with the study is good, but not good enough for the environment and health of people, which still need increase in compliance, to reduce improper management of health care waste.

- **Challenges faced by administrators and operational workers in the health care establishments of the municipality on HCRWM and compliance with the regulations**

In the study, it was found that there are challenges faced in HCRW management that also lead to non-compliance with the regulation. The most important challenges faced in the study was found to be a lack of knowledge due to lack of training on the health care waste management and regulation. The study concluded that lack of training also leads to improper management of waste, including improper segregation of waste from the point of generation. It was also found that ignorance and operational workers' attitude toward the management and compliance is also a problem that leads to non-compliance with the regulation. Lack of proper storage was also found to be a challenge to most of the establishments in Thulamela Local Municipality. The study concluded that the overall causes of improper management and malpractices of the health care waste are include lack of government interest and monitoring, limited knowledge, training and awareness for health care operational workers and administrators.

## 5.2 Recommendations

The following recommendations are made from the findings in relation to each objective of the study:

- Health care waste generated in each establishment should be weighed before collected by the service provider and monthly records for waste generated should be kept properly for quantifying statistics of health care waste generated, which will assist in making informed decisions regarding health care waste generated and disposed of.
- Proper regular training should be provided to all health care operational workers (auxiliary staff, nurses, doctors, cleaner, and transporters) and everyone involved in health care waste management, for the proper management process and compliance with the regulation, and patients should be made aware of the proper segregation.
- The Department of Health should establish, implement programs for health care waste management for controlling and improving the existing situation and periodically do the evaluations for effective training and education programs.
- The waste cleaners as well as waste transporters should be educated on the dangers of improper handling HCRW and the importance using personal protective clothing, and they should be provided enough protective clothes and discrete containers.
- Health care waste management policy or legislation should be in place to regulate how the waste would be managed, administrators to be aware of the objectives of the policy and there should be a management plan from the policy.
- Administrators/managers should ensure that there is a proper temporary storage for HCRW, with all requirements according to the regulation. Follow up on the health care waste collected and transported out of the establishment should be done to check if it has been appropriately treated and disposed of in to minimize risks to the environment and human health, and certificate of safe treatment and disposal should be given back to the establishments
- It is also recommended that the government should give licenses to private companies to own incinerators and other treatment facilities.
- Emphasis should be in place for monitoring of compliance and internal.

## **Recommendations for future research**

This study only focused on Thulamela public health care establishments, and due to the limitation of the study, further studies are recommended to expand from this study, even to other provinces and countries, nationally and also include private health care establishments. It was found that there are limited studies conducted on the level of compliance with health care waste management legislations. Therefore, it is recommended that further studies should also evaluate compliance with legislations in health care establishments.

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## APPENDICES

### Appendix 1: Respondent information letter

#### LETTER OF INFORMATION

**Research title:** Assessing the level of compliance with current Health Care Risk Waste (HCRW) management regulation in health care establishments at Thulamela municipality, Vhembe district, South Africa.

**Researcher:** Nematenda Pfunzo Priscilla, Environmental Sciences Masters' student at University of Venda with student number 18003694, under School of Environmental Sciences, Department of Ecology and Resource Management.

**Supervisors:** Prof J.S, Ogola and Dr N.V, Mudau (Co-supervisor)

**Procedures:** The purpose of the study is to assess the level of compliance with health care waste management regulation in health care establishment at Thulamela Municipality. Semi-structured interview and questionnaire will be utilized to gather data from the respondents and the observation checklist will be used to record information observed from the Thulamela Municipality health care establishments. A participant will spend approximately 30 minutes to respond to the interview, 30 minutes to complete the questionnaire and a respondent is expected to give an honest information required.

**Risk and Benefits for participation:** No harm or injury will be intended on any participant; the researcher will ensure that there was no emotional and physical harm to the participants. There are no trick questions in this survey and no right or wrong answers. The benefits that a participant can gain is more information or better understanding about HCRW management regulation.

**Consent:** Be knowledgeable that participation in this study is voluntary, you are free to withdraw at any time without penalty and you are under no obligation to take part in this study. If you decide to continue with the participation you will be treated fairly.

**Confidentiality:** All participants are entitled to privacy about their thoughts and beliefs. No personal particulars will be revealed in public, information collected from this study will be kept confidential and will not be disseminated to other parties without your permission

**Remuneration:** A participant should not expect any remuneration or any monetary, but your participation will be greatly appreciated.

For any enquiries please feel free to contact the researcher (0620081925) or my supervisor (015968580) or the University Research Ethics Committee Secretariat on 015 962 9058. Complaints can be reported to the Director: Research and Innovation, Prof GE Ekosse on 015 962 8313 or Georges Ivo.Ekosse@univen.ac.za

UNIVEN Informed Consent

## Appendix 2: Respondent Consent form

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### CONSENT

Statement of Agreement to Participate in the Research Study:

I hereby confirm that I have been informed by Priscilla Nematenda, about the nature, risks and benefits of the study.

I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.

I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.

In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.

I may, at any stage, without prejudice, withdraw my consent and participation in the study. I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

I understand that significant new findings developed during this research which may relate to my participation will be made available to me.

Participant signature ..... Date.....

**I Nematenda Priscilla Pfunzo** herewith confirm that the above participant has been fully Informed about the nature, conduct and risks of the above study.

Researcher's Signature..... Date.....

UNIVEN Informed Consent

### Appendix 3: Interview guide or questions for the administrators



#### Assessment of the Level of Compliance with Current Health Care Risk Waste Management Regulations in Health Care Establishments in Thulamela Local Municipality by Nematenda P.P

1. How long have you been working in this health care facility?
2. Do you have health care waste (HCW) policy in this health care facility? If no, give reason
3. What are the objectives the health care waste policy in place in this facility?
4. Are your employees aware and able to access the policy or guideline?
5. Do you have waste HCW management plan in place in your health facility?
6. Does this facility have waste management committee? If yes, with which committee members and it is doing function?

The Chief Executive Officer / Facility Manager	
The designated and / or appointed Health Care Waste Officer	
A representative of the section responsible for Procurement	
A representative of the section responsible for Cleaning and Hygiene Services	
An Infection and Prevention Control Officer	
An Occupational Health and Safety Officer;	
A Quality Control Officer	
Environmental Health Practitioner of the area	

7. Do all the health care employees receives training and awareness on an ongoing basis in the correct segregation, and proper management process of HCW? If yes are the records kept for such trainings?
8. Do all health care workers have all necessary Personal Protective Equipment (PPE)? If yes are records kept
9. Are there records kept on the amount and type of health care waste generated in this facility?
10. Do you have an intermediate (wards containers) and central storage areas for HCW storage?
11. Do you dispose any waste in this facility? If no, how often does the waste generated collected and transported out of this facility for treatment and disposal?
12. Is there proper packaging and labelling for HCW to be transported?
13. Do you receive any proof of HCRW treatment and disposal, are they kept for records?
14. How can you rate the compliance level with management process (from the point of generation to the last point of disposal) of operational workers in this facility? (excellent, good or poor)
15. Do you face any challenge in HCW management that lead worker not to comply with the policy?
16. How often do you review policy and the waste management guideline?

## Appendix 4: Questionnaire for the operational workers



Assessment of the Level of Compliance with Current Health Care Risk Waste Management Regulation in Health Care Establishments in Thulamela Local Municipality by Nematenda P.P

### Section A: Demographic Characteristics of the Respondent

1. Gender 

Male	<input type="checkbox"/>	Female	<input type="checkbox"/>
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2. Age 

21-25yrs	<input type="checkbox"/>	26-30yrs	<input type="checkbox"/>	31-35yrs	<input type="checkbox"/>	Above 35yrs	<input type="checkbox"/>
----------	--------------------------	----------	--------------------------	----------	--------------------------	-------------	--------------------------

3. Occupation 

Nurse	<input type="checkbox"/>	Doctor	<input type="checkbox"/>	Other (specify)	<input type="text"/>
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4. Years of experience in the health establishment

0-3yrs	<input type="checkbox"/>	4-7yrs	<input type="checkbox"/>	8-11yrs	<input type="checkbox"/>	12-15yrs	<input type="checkbox"/>	Above 16yrs	<input type="checkbox"/>
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### Section B: Types of HCRW generated

1. Is there any guideline or policy on health care waste management? 

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
-----	--------------------------	----	--------------------------

If yes how accessible is it to all healthcare operational workers.....

2. Which of the following waste is generated at this health care establishment? (Tick the appropriate answer(s), **if you don't generate go to section C**)

Sharps (used cannulas, needles, surgical blades, vials Injections, syringes)	<input type="checkbox"/>
Used gloves and bandages	<input type="checkbox"/>
Radioactive waste (from radiotherapy and laboratories)	<input type="checkbox"/>
Chemical and pharmaceutical waste	<input type="checkbox"/>
Pathological (human tissues, organs, blood and body parts)	<input type="checkbox"/>
Others (specify):	<input type="text"/>

2. From the above selected categories of waste generated, which one(s) is the most generated?

3. Which one(s) is the least generated?

**Section C: The knowledge and management of HCRW**

1. The regulation stated that All health care waste shall be segregated at the point of generation and shall be contained to minimize the risk of contamination or pollution to human health and the environment.

Q: Do you segregate health care risk waste from general waste from point of generation?

Yes		No	
-----	--	----	--

If no, give reason why

2. Did you receive those training on the HCRW and are the records kept? 

Yes		No	
-----	--	----	--

3. Do you know about color-coding segregation of HCRW waste? 

Yes		No	
-----	--	----	--

If yes indicate by a tick the correct segregation color coding you know

	Black	Red	Blue	Green	Yellow
General or non-risk waste					
Risks waste without sharps					
Risk waste with sharps					
Chemical/pharmaceutical waste					

4. Which protective clothe did you receive from this institution. Tick appropriate answer/s

Gloves	
Face masks	
long-sleeved gown	
Plastic apron	
Boots	

5. Are you aware that improper disposal or management of HCRW such as sharps pose a risk to patients, other personnel as well community? 

Yes		No		Do not know	
-----	--	----	--	-------------	--

6. Are you aware that If sharps are not properly handled or disposed of can result in injuries and lead to infection with Hepatitis B, C, and HIV? 

Yes		No		Do not know	
-----	--	----	--	-------------	--

7. Do you know that improper disposal of HCRW also threaten the environment e.g. when Syringes washing up on seashores, and Pathogens contaminating healthy drinking water supplies and fresh air? 

Yes		No		Do not know	
-----	--	----	--	-------------	--

8. Used needles should be discarded in designated sharp container and should be discarded immediately after use? Indicate the extent you agree or disagree with the statement.

Strongly agree		Agree		Do not know		Disagree		Strongly disagree	
----------------	--	-------	--	-------------	--	----------	--	-------------------	--

**SECTION D: Challenges, Recommendations and comments**

1. What are the problems you encounter in managing HCRW in your health care establishment?

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2. What recommendations would you give for the improvement of HCRW management in Thulamela municipality health care establishments?

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3. Any other Comments

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## Appendix 5: Observation checklist



Assessment of the Level of Compliance with Current Health Care Risk Waste Management Regulation in Health Care Establishments in Thulamela Local Municipality by Nematenda P.P

1= Disagree, 2= Slightly, 3= Agree

Description	1	2	3
<b>HCRW Segregation and colour-coding containerisation</b>			
1. Correct segregation of: General waste in Black container			
2. Sharps with risk waste in Yellow container, with recognized symbol Sharp's container closed when $\frac{3}{4}$ full			
3. Infectious in Red container, with recognized symbol			
4. Anatomical in Orange container, with recognized symbol			
5. Chemical and pharmaceutical in Green container			
<b>Storage of HCRW</b>			
Proper storage intermediate and central for HCW with proper containers			
<b>HCRW Collection and Transportation</b>			
1. Proper Internal collection and transportation from intermediate storage room to central storage, and from central to outside the facility for disposal			
2. Weighing, off-site collection and transportation by service provider with a proof of collection, signed by the institution's representative			
3. Proper packaging and labelling for HCW to be transported			
<b>Proper Protective clothing for collection</b>			
1. Gloves			
2. Face masks			
3. long-sleeved gown			
4. Plastic apron			
5. Boots			
<b>HCRW Disposal and Treatment</b>			
2. Proof of HCRW treatment and disposal			

Comments

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Appendix 6: Research ethical clearance certificate

RESEARCH AND INNOVATION  
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:

**Ms PP Nematenda**

Student No:

**18003694**

**PROJECT TITLE: Assessment of level of compliance with current health care risk waste management regulations in health care establishment in Thulamela Municipality, Vhembe District, South Africa.**

PROJECT NO: **SES/19/ERM/03/2304**

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Prof JS Ogola	University of Venda	Supervisor
Dr NV Mudau	University of Venda	Co - Supervisor
Ms PP Nematenda	University of Venda	Investigator - Student

ISSUED BY:

**UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE**

Date Considered: April 2019

Decision by Ethical Clearance Committee Granted

Signature of Chairperson of the Committee: 

Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse




University of Venda

PRIVATE BAG X5050, THOHAYANDOU, 0950 (LIMPOPO PROVINCE), SOUTH AFRICA  
TELEPHONE (015) 962 8504/9313 FAX (015) 962 9060

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UNIVERSITY OF VENDA
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2019-04-25
Private Bag X5050 Thohoyandou 0950

## Appendix 7: Research approval from Limpopo Provincial Department of Health



# LIMPOPO

PROVINCIAL GOVERNMENT  
REPUBLIC OF SOUTH AFRICA

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## DEPARTMENT OF HEALTH

Ref: LP\_201905\_005

Enquires : : Dr Ramalivhana NJ  
Tel : : 015-2936208  
Email : : [Naledzani.ramalivhana@dohed.limpopo.gov.za](mailto:Naledzani.ramalivhana@dohed.limpopo.gov.za)

NEMATENDA PFUNZO PRISCILLA  
Vhembe District, South Africa  
School of Environmental Sciences  
University of Venda


**PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES**

Your Study Topic as indicated below:

**DEPARTMENT OF ECOLOGY AND RESOURCE MANAGEMENT ASSESSMENT OF THE LEVEL OF COMPLIANCE WITH CURRENT HEALTH CARE RISK WASTE MANAGEMENT REGULATION IN HEALTH CARE ESTABLISHMENTS IN THULAMELA MUNICIPALITY, VHEMBE DISTRICT, SOUTH AFRICA.**

1. Permission to conduct research study as per your research proposal is hereby Granted.
2. Kindly note the following:
  - a. Present this letter of permission to the institution supervisor's a week before the study is conducted.
  - b. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
  - c. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
  - d. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
  - e. The approval is only valid for a 1-year period.
  - f. If the proposal has been amended, a new approval should be sought from the Department of Health
  - g. Kindly note that, the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated



Head of Department  
Dr Mhlongo TF

23/06/19  
Date

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Private Bag X9302 Polokwane  
Fidel Castro Ruz House, 18 College Street, Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.  
Website: <http://www.limpopo.gov.za>

*The heartland of Southern Africa – development is about people*

## Appendix 8: Research approval from Vhembe District Department of Health



**LIMPOPO**  
PROVINCIAL GOVERNMENT  
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH  
VHEMBE DISTRICT

Ref: S5/4/2/3

Enq: Mr. Chauke HS

Date: 28 June 2019

TO: NEMATENDA P.P

**SUBJECT: PERMISSION TO CONDUCT MEDICAL WASTE RESEARCH IN VHEMBE DISTRICT PRIMARY HEALTH INSTITUTIONS.**

1. The above matter has reference
2. Kindly be informed that permission to do the above mentioned at Vhembe District Health institutions from 01 July 2019 – 30 August 2019 has been granted.
3. You are also advised to comply or adhere with the Departmental Policies, rules and regulations during your operations.

Hoping that you will find this in order .



CHIEF DIRECTOR: HEALTH SERVICES

28/6/2019  
Date

Private Bag X1009 TLOHOYANDOU 0950  
OLD parliamentary Building Tel (05) 962 1000 (Health) (05) 962 4958 (Social Dev) Fax (05) 962 2274/4823

***The heartland of Southern Africa – development is about people!***

## Appendix 9: Letter from the research editor

P.O BOX 663  
THOLONGWE  
0734  
20 February 2020

Dear Sir/Madam

This serves to confirm that I proof-read and edited dissertation entitled "Assessment of the Level of Compliance with Current Health Care Risk Waste Management Regulation in Health Care Establishments in Thulamela Local Municipality, Vhembe District, South Africa" by Nematenda Pfunzo Priscilla, student number: 18003694.

I have also suggested few amendments, provided the changes I recommended are effected to the text, the language is of an acceptable standard.

Please don't hesitate to contact me for any enquiry.

Regards



Dr. Havisomhlanga (BEDSPF-UL, BA Hons-UL, MA-IUP: USA, PHD-WITS, PGDIP-SUN)

Cell number: 079-721-0620/078-196-4459

Email address: havisomhlanga@yahoo.com