Practices of Nurses on Medical Waste Segregation at Selected Health Care Facilities in Sekhukhune District, Limpopo Province

By

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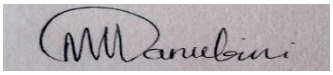
DECLARATION

I, Marubini Mufhumudzi hereby declare that the mini-dissertation entitled ***"Practices of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province"*** has not been submitted previously for any other degree at this or any other institution, it is my own work and all sources that I have used or quoted have been indicated and acknowledged using complete reference.

Signature  Date: 11-02-2021

DEDICATION

This mini-dissertation is dedicated to my late dad, Marubini T. D and my mom, Marubini M. J for always believing in me and wanting the best for me. They made me who I am today because of their guidance and endless prayers. I am saying this achievement is yours and I wish you were still alive to witness my success. May their souls rest in peace.

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ABSTRACT

Background: Medical waste is a concern because it can cause potential environmental hazards and public health risks. Nurses produce medical waste when carrying out their daily health activities. **Purpose:** The purpose of the study was to describe the practices of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province. **Methodology:** A quantitative approach and cross-sectional design were used. The setting of the study was the primary health care facilities in Ephraim Mogale, Sekhukhune District, Limpopo Province. The population of this study were nurses and the total population sampling was used. Out of 147 questionnaires, 133 questionnaires were returned. Data was collected through a self-administered questionnaire and analysed using Statistical Package for Social Science (SPSS) version 26. Graphs and tables were used to present results. Ethical considerations were observed. **Results:** The findings showed that 88.7% of the respondents were females and 11.3% were males. More than half of the respondents (54.1%) were above 35 years, 69.9% were professional nurses, 10.5% were staff nurses and 19.5% were assistant nurses, and 27.1%% had 0-5 years of experience. Findings also revealed that 77.4% of the respondents had excellent knowledge, 21.1% had a good knowledge and 1.5% had poor knowledge of medical waste segregation. Most respondents (77.4%) had an excellent practice, 21.8% had good practice and 0.8% had poor practice. **Conclusion:** It was concluded that nurses in Sekhukhune District, Ephraim Mogale sub-district had knowledge and practices of medical waste segregation in place but still lack knowledge about colour coding and lack practice on labelling and replacing medical waste containers. **Recommendations:** it is recommended that training on the management of medical waste must be done frequently to increase the existing knowledge and practices.

Keywords: Medical waste, Nurses, Practice, Waste disposal, Waste segregation

Table of Contents

DECLARATION i
DEDICATION ii
ACKNOWLEDGEMENTS iii
ABSTRACT iv
LIST OF ACRONYMS AND ABBREVIATION viii
LIST OF FIGURES ix
LIST OF TABLES x
CHAPTER 1 1
1.1. Introduction 1
1.2. Background to the study 1
1.3. Research problem 3
1.4. Rationale of the study 3
1.5. Significance of the study 4
1.6. Study purpose 4
1.7. Study objectives 4
1.8. Definition of terms 4
1.9. Conclusion 5
1.10. Chapter Outline 5
1.11. Summary of the chapter 6
CHAPTER 2 7
LITERATURE REVIEW 7
2.1. Introduction 7
2.2. Purpose of literature review 7
2.3 Scope of the literature Review 7
2.4. Types of medical waste 7
2.4. Policies and legislative requirements on medical waste 8
2.5. Knowledge of health care workers including nurses on medical waste segregation 12
2.6. Practices of nurses regarding medical waste segregation 14
2.7. Health effects of improper medical waste segregation 15
2.8. Theoretical framework/model 16
2.9. Chapter summary 17
CHAPTER 3 18
METHODOLOGY 18

3.1. Introduction 18
3.2. Research approach 18
3.3. Study Design 18
3.4. Study setting 19
3.5. Study population 20
3.5.1. Population frame 20
3.6. Sampling 20
3.7. Inclusion criteria 20
3.8. Measuring instrument 20
3.9. Pre-test 21
3.10. Validity 21
3.11. Reliability 22
3.12. Data collection 22
3.13. Data management and analysis 23
3.14. Ethical considerations 23
3.15. Summary of the chapter 25
CHAPTER 4 26
ANALYSIS AND PRESENTATION OF DATA 26
4.1. Introduction 26
4.2. Socio-Demographical Information 26
4.2.1 Gender 26
4.2.2. Age 26
4.2.3. Professional category 27
4.2.4. Years of experience 27
4.3. Knowledge of nurses on medical waste segregation 28
4.3.1. Percentages of nurses' knowledge on medical waste segregation 30
4.4. Practices of nurses on medical waste segregation 30
4.4.1. Percentages of nurses' practices on medical waste segregation 33
4.5. Relationship between practice and knowledge of nurses regarding medical waste segregation. 33
4.6. Chapter summary 34
CHAPTER 5 35
DISCUSSION OF RESULTS 35
5.1. Introduction 35
5.2. Socio-demographic characteristics of the respondents 35
5.3. Knowledge of nurses regarding medical waste segregation 36

5.4. Practices of health care workers regarding medical waste segregation 37

5.5. Relationship between practice and knowledge of nurses regarding medical waste segregation 39

5.6. Chapter summary 40

CHAPTER 6 41

SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION 41

6.1. Introduction 41

6.2. Summary of the study 41

6.3. Limitation of the study 43

6.4. Recommendations 43

6.4.1. Recommendations for knowledge and practice: 43

6.4.2. Recommendations for future studies: 43

6.5. Conclusions 43

REFERENCES 45

APPENDIX A: LETTER OF INFORMATION 52

APPENDIX B: CONSENT FORM 54

APPENDIX C: QUESTIONNAIRE 55

APPENDIX D : APPROVAL LETTER FROM UHDC 60

APPENDIX E: ETHICAL CLEARENCE 61

APPENDIX F: APPROVAL LETTER FROM DEPARTMENT OF HEALTH 62

APPENDIX G: APPROVAL LETTER FROM SEKHUKHUNE DISTRICT 63

APPENDIX H: EDITING AND PROOFREADING REPORT 64

LIST OF ACRONYMS AND ABBREVIATION

AIDS:	Acquired Immunodeficiency Syndrome
KAP: `	Knowledge, Attitude and Practice
HIV:	Human Immunodeficiency Virus
HPCSA:	Health Professions Council of South Africa
NEMA:	National Environmental Management Act
SANS:	South African National Standards
SEMA:	Specific Environmental Management Act
WHO:	World Health Organization

LIST OF FIGURES

Figure 1: The current legal framework for management of health care risk management…8

Figure 2: Theoretical framework/model……16

Figure 3: Sekhukhune District Map showing Ephraim Mogale Municipality…… 19

Figure 4: Percentages of nurses by age group……26

Figure 5: Percentages of nurses' years of experience……...27

Figure 6: Chart showing percentages of nurses' knowledge……30

Figure 7: Chart showing nurses practices regarding medical waste segregation……33

LIST OF TABLES

Table 1: Summary of colour coding……13

Table 2: Ephraim Mogale Population frame……20

Table 3: Frequency and percentage distribution of nurses by gender……26

Table 4: Table showing frequency and percentage distribution of professional category……27

Table 5: Knowledge of nurses regarding medical waste segregation……28

Table 6: Table showing practices of nurses regarding medical waste segregation……30

Table 7: Showing correlation between knowledge and practice of nurses……33

CHAPTER 1

OVERVIEW OF THE STUDY

1.1. Introduction

This study focuses on the practices of nurses on medical waste segregation. The chapter outlines the background to the study, research problem, the significance of the study, purpose and objectives of the study. A literature review outlines the existing problem and related studies that already exist. The methodology used including study design, setting, population, sampling, inclusion criteria, measuring instrument, validity, reliability, data collection, data management, analysis and ethical considerations is also explained. The study results are also interpreted and discussed.

1.2. Background to the study

Medical waste is any waste produced by health care workers including nurses when protecting and restoring the community's health (Makhura, Matlala & Kekana, 2016). This waste can be generated when diagnoses and treatments are conducted in health care facilities and management of such wastes is a concern because there are public health risks associated with them (Awodele, Adewoye & Oparah, 2016). The Health Care Waste Report indicated that 85% of waste is generated as non-hazardous waste and the remaining 15% is considered hazardous materials that can be infectious and every year an estimated 16 billion injections are administered worldwide but not all the needles and syringes are properly disposed (WHO, 2018).

A global lack of knowledge and practices of health care workers on medical waste segregation has been revealed. This was supported by a study in a tertiary hospital in Pakistan on practices and challenges of medical waste which revealed that there was a serious gap observed related to practices on medical waste segregation leading to improper waste management due to poor resources and lack of infectious waste training among health care workers (Kumar, Shaikh, Somrongthong & Chapman, 2015). This was supported by another study in Ethiopia on practices of waste segregation among health care workers which revealed poor practices of waste segregation due to insufficient training on standard precautions of waste segregation (Sahiledengle, 2019).

Furthermore, another study in India on biomedical waste management among health care workers revealed that there was a visible gap between knowledge, attitude, and practices that needs to be addressed to prevent biomedical waste hazards (Bhatt, Maroof, Awasthi,

Bahuguna, Kanubhai & Pamei, 2020). However, another study in India on biomedical waste management in a teaching institution revealed that nurses and doctors had good knowledge, attitude, and practices regarding waste management and reported that they had good knowledge because training on waste management was done weeks before data collection. (Anand, Jain & Dhyani, 2016).

In African countries, lack of knowledge, poor administration, poor infrastructure, and technology to deal with medical waste are challenges to waste management (Malebatja, 2016). In Southeast Nigeria, Anozie, Lawani, Eze, Mamah, Onoh, Ogah & Umezurike (2017) found that there was poor knowledge on standard medical waste management and that nurses were not complying with the waste management procedures because there was a lack of regular training and update on occupational safety measures. Similarly, in Nigeria, Awodele et al (2016) found that on the assessment in seven hospitals there was poor practice of medical waste management due to lack of policies or guidelines in all hospitals for managing waste because nurses and other hospital's health care workers were mixing medical waste material.

However, in Botswana, Mugabi, Hattingh & Chima (2018) found that practices on medical waste management were above average but there was still a need for improvement on accessing medical waste disposal points and availability of personal protective equipment. In Kenya, Muthoni, Nyerere & Ngugi (2016) discovered a high level of knowledge on medical waste management and inappropriate practices due to improper facilities and lack of individual's interest.

As in other countries, in South Africa, medical waste segregation remains a problem. Olaniyi, Ogola & Tshitangano (2018) reported poor practices of medical waste management from point of generation to disposal and non-compliance of medical waste guidelines in provinces where they exist. These researchers attributed these poor practices to lack of regulations and guidelines of medical waste management. In Mpumalanga Province, health care workers had insufficient knowledge on the disposal of the medical waste but nurses had better knowledge on proper medical waste disposal practice (Malebatja, 2016).

In Kwazulu Natal, Olaifa, Govender & Ross (2018) found that staff members had inadequate knowledge and practices of health care waste management because of inappropriate training and supervision. However, they had good attitude towards waste management. In George Masebe hospital in the Limpopo Province, Malebatja (2016) found insufficient knowledge about handling and disposal of medical waste because the hospital was lacking proper biomedical protocols.

The present study was conducted to assess the knowledge and to describe practices of health care workers on medical waste segregation in Sekhukhune District.

1.3. Research problem

All health care workers must abide by the proper handling, disposal procedures, and storage of waste to minimize the health risks associated with improper medical waste management because medical waste segregation forms part of the infection control (Malebatja, 2016). Though there are policies and regulations on waste management, health care workers still fail to comply with standardised procedures on the handling of medical waste.

The researcher is a professional nurse at one of the clinics in Ephraim Mogale and has observed medical waste segregation confusion among nurses. Some nurses were disposing infectious waste in non-infectious waste containers. The researcher also observed that nurses were disposing of empty packets of medication, webcols, and dry gauzes that have been used in the process of injecting patients in non-infectious instead of infectious waste bins. Another observation was that they were mixing needles with vials.

Another challenge that was observed by the researcher was the failure of enforcement of medical waste management regulations because nurses were still mixing waste and incorrectly separating it despite being properly supervised. This was supported by the observation of monthly statistics where nurses were failing to score 100% though there was enforcement of rules. Monthly, nurses scored between 60-70%. This observation was done between October 2017 and March 2018. Therefore, the researcher wanted to investigate the knowledge and practices of health care workers regarding medical waste segregation.

1.4. Rationale of the study

Knowledge and practices of medical waste management is still a challenge although many studies have been conducted world-wide on medical waste management. This was supported by a health care waste report indicating that an estimated 16 billion injections are administered world-wide but not all the needles and syringes are disposed properly (WHO, 2018). Olaniyi et al (2018) reported that in south Africa, there is poor practice of medical waste management from point of generation to disposal. As far as research shows, there are no studies that have been conducted about the practice of nurses on medical waste segregation in Sekhukhune district, Ephraim Mogale sub-district. Therefore, this study describes the practices of nurses on medical waste segregation in Sekhukhune District, Ephraim Mogale sub-district.

1.5. Significance of the study

The study will benefit the Department of Health and assist the primary health care management in identifying factors that are leading or contributing to non-compliance with waste management. The study might also help policymakers to plan and develop policies related to medical waste management to strengthen the proper values of medical waste segregation. Furthermore, the study will benefit Sekhukhune district by adding to existing knowledge on segregation of medical waste. This may also lead to an improvement of the nursing curriculum.

1.6. Study purpose

The study describes practices of nurses on medical waste segregation at selected health care facilities in Limpopo Province.

1.7. Study objectives

- To assess nurses' knowledge about medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province.
- To describe the practice of nurses about medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province.
- To determine the relationship between knowledge and practice of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province.

1.8. Definition of terms

Knowledge is the understanding that one has gained through experience or learning (Girard & Girard, 2015). In this study, knowledge refers to the understanding that one has on medical waste segregation.

Practice means doing something regularly in order to become better (Ali, Ijaz, Aman, Nasir, Anjum and Randhawa, 2017). In this study, practice refers to how nurses apply their knowledge into action towards medical waste segregation

Medical waste: All waste produced in health care facilities and diagnostic activities (International Committee of the Red Cross, 2011). In this study, medical waste refers to

sharps, vials, used gloves, soiled bandages and any waste with blood or any body fluids that has been used in the process of restoring patient's health.

Waste segregation: Waste segregation is the separation of waste according to classification prior to storage (Health Professions Council of South Africa, 2008). In this study, waste segregation refers to the separation of waste into the correct labelled containers.

Waste Disposal: Waste disposal is the removal of waste to the final storage after it has been treated. (WHO, 2014). In this study, waste disposal refers to how nurses dispose of medical waste following the waste management policies and guidelines.

1.9. Conclusion

This chapter provided an overview of the research, introduction and the background to the study, research problem and study rationale, significance of the study, study purpose and objectives. Further, the chapter defined key terms of the study.

1.10. Chapter Outline

Chapter One: Introduction and background

This chapter introduces the introduction and gives the background to the study. It discusses the research problem, significance of the study, study purpose, study objectives, and defines the study's key terms.

Chapter Two: Literature review

This chapter reviews information that is related to the study and identifies a gap in knowledge regarding medical waste separation by nurses. The review focuses on medical waste, medical waste segregation, health care waste, waste management policies, knowledge and practices of medical waste, and the impact of medical waste practices.

Chapter Three: Methodology

This chapter outlines the study methodology. It discusses the study design, study setting, study population, sampling, inclusion criteria, measuring instrument, criteria for data quality, and data collection. Furthermore, it discusses data management, data analysis, validity and reliability and ethical considerations.

Chapter Four: Results

The chapter presents the results of the study in the context of the aim and objectives of the study. These results are presented in frequencies and percentages in tables, charts, graphs and in chi-squares.

Chapter Five: Discussion

Research findings are discussed in this chapter and are compared with the existing literature related to the study. The discussion focuses on the knowledge and practice of nurses on medical waste segregation and the relationship between knowledge and practice.

Chapter Six: Conclusion, limitations and recommendations

This chapter provides a conclusion to the study, discusses limitations of the study and makes recommendations.

1.11. Summary of the chapter

This chapter presented an overview of the study, introduction, background to the study, research problem, study rationale, significance of the study, study purpose, and objectives. Further, it defined the study's key terms and gave the outline of the entire study. Chapter 2 below provides the study's literature review.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

The previous chapter presented the background, research problem, significance, purpose, study objectives and defined the study's terms. This chapter reviews literature which assisted the researcher to adequately frame the current study. The literature review identified a gap in knowledge that this study seeks to fill. Reviewed literature was from journals, studies conducted on medical waste management and from web search in databases such as Science Direct, Greenfile, Medline, Environment Complete, and Health Source. For web search, the following keywords words were used: medical waste, health care waste, waste management policies, knowledge, and practices of medical waste and impact of medical waste practices. This helped the researcher to find information and ideas that are related to the present study.

2.2. Purpose of literature review

A literature view conveys to the reader what is currently known regarding a topic of interest (Brink, Van Der Walt & Van Rensburg, 2017). It reveals what has been done and reported by other researchers and assists the researcher to identify a gap in knowledge. Reviewing literature also helped the researcher to compare findings of other studies about the global practice of medical waste management.

2.3 Scope of the literature Review

The scope of literature review is the extent of the area or range of view, its application, operation or subject matter guide on how the investigation or discussion unfolds.

2.4. Types of medical waste

The World Health Organization (2018) defines medical waste as all waste that is being generated within healthcare facilities, laboratories, and research centres that is related to medical procedures. Olaniyi et al (2018) also refers to it as health care waste. Medical waste is differentiated as non-infectious waste and infectious waste. Infectious waste is then sub-

classified into pathological waste, sharps, pharmaceutical waste, radioactive waste, chemical waste, cytotoxic agents, and human or anatomical waste (HPCSA, 2008)

Sharps waste is any material with an acute rigid corners or edges that can pierce and cut. These include syringes with attached needles, needles, blades, and lancet with or without a tube or any broken clinical glass pipettes. There is also pharmaceutical waste. These are residues of medicines that are no longer usable such as unused medicines, drugs, expired medication and vaccines (Geozone Environmental, 2016).

Infectious waste includes all infectious products from patients such as surgical waste or medical waste or lab waste that is contaminated (HPCSA, 2008). Anatomical waste is human and animal tissues, body parts, or organs. Cytotoxic is any waste from the medication that kills the growth of cells such aa chemotherapy (Geozone environmental, 2016).

Chemical waste is classified as hazardous and non-hazardous. Hazardous chemicals include toxic, flammable, or reactive material such as explosive. Non-hazardous chemicals include amino acids, sugars, organic or inorganic salts (Chartier, Emmanuel & Pieper, 2014). The HPCSA (2008) describes pathological waste as any waste that is generated from body fluids such as blood and semen.

2.4. Policies and legislative requirements on medical waste

People living in South Africa have a right to live and work in an environment that is not harmful to their wellbeing and health as written in the national constitution (Geozone environmental, 2016). The Department of Health must develop and enforce a national policy to guide the management of medical waste (Olaniyi et al, 2018). The figure below shows the current legal framework for the management of health care risk waste.

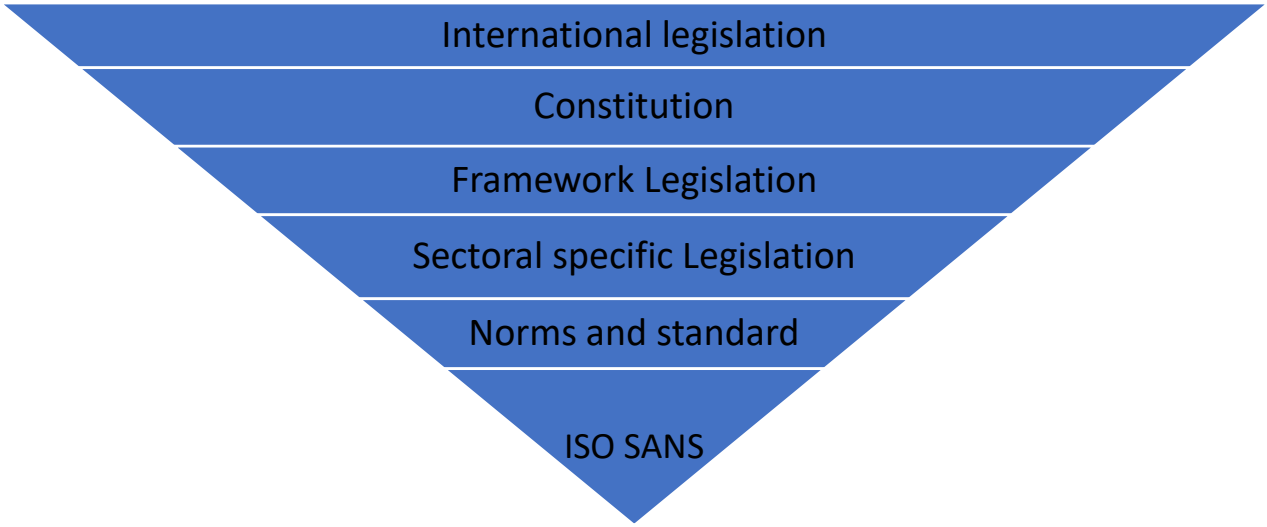

Figure 1: The current legal framework for the management of health care risk management (Malebatja, 2016)

International legislations

At the international level, guidelines have been developed to manage health care waste and protect the public from the its possible hazards. In 1994, South Africa became part of the International legislation that is governing the management of waste. A manual has been developed by WHO to guide countries in the management of health care waste and a guidance note was put in place by the World Bank to complement WHO's efforts on health care waste management (World Bank, 2000).

Some of the key regulations for better health care waste management and achievement of low standard of environmental pollution were the Basel Conversion on the control of transboundary movements of hazardous waste, the International register of potential toxic chemicals 1985 and the United Nations Environmental code 1993 (Malebatja, 2016). This means that South Africa should participate in international legislation to protect the country against risks associated with health care waste.

The constitution

In South Arica, the practice of waste management is guided by Act no 108 of 1996 in the Bill of Rights where it states that every citizen has the right to live in an environment that is not harmful to their health and well-being. It further states that citizens must have an environment that is protected for present and future benefits by legislation that prevent pollution and ecological degradation. The country should ensure that any medical waste practice that causes pollution is punished according to the law.

Framework legislation

The National Environmental Management Act 107 of 1998 is accountable for accommodating environmental governance by creating principles for decision-making for individuals, institutions, and government on matters affecting the environment and provides for certain aspects of administration and enforcement of other environmental management laws.

NEMA serves as a general framework from which the management and implementation of the environment must be formulated. The principle of the National Environmental Management includes that waste must be avoided, minimised, reused, or recycled where possible and disposed of correctly. It also states that pollution and degradation of the environment must be avoided and guarantees the right of the workers to refuse work that is harmful to their health and environment

Sectoral specific Legislation

Sectoral specific Legislation includes SEMA (specific environmental management act). According to NEMA, SEMA means the Environmental Conservation Act no 73 of 1989, The National Water Act 1998 no. 36mof, five National Environmental Management which are: Protected Areas Act, 2003 (57 of 2003), Biodiversity Act, 2004 (10 of 2004), Air Quality Act, 2004 (39 of 2004), Integrated Coastal Management Act, 2008 (24 of 2008) and Waste Act, 2008 (59 of 2008) and the World Heritage Convention Act, 1999 (49 of 1999).

Some of these Acts can be used in the management of medical waste. The National Environmental Management: Air Quality Act 39 of 2004 aims to protect air quality in South Africa by preventing air pollution and environmental degradation and regulates the incinerators emission standards that are used in the treatment of medical waste. There is also a National Environmental Management: Waste Act 59 of 2008 which provides a licensing process for specified waste activities and deals with different types of waste.

Other legislations that are interrelated with medical waste include, the Hazardous Substances Act 19 of 1973 that deals with the management of waste capable of causing harm to the individual and environment. This is essential for health care workers as they handle hazardous substances. The National Health Act 61 of 2005 has regulation GNR 363 of 2013 that deals with the management of human remains and how it should be handled, stored, disposed and their final treatment. The National Road Traffic Act 93 of 1996, regulates the transportation and handling of waste on the roads, the type of vehicles that should be used, and the temperature regulations.

Occupational Health and Safety Act 85 of 1993 enforces the provision of personal protective clothing to the handlers of waste to prevent transmission of infections and diseases. The Act also helps to eliminate possible dangers that can cause infections.

Norms and standards

Some policies and standards regulate health care risks. For example, there is the Waste Management Policy drafted by the Department of Water Affairs and Forestry in 1998 which stipulates three documents for the management of waste.

1. Minimum requirements for handling, classification, and disposal of hazardous waste

This sets out the classification of waste as general and hazardous waste according to their toxicological properties.

2. Minimum requirements for waste disposal landfill

This governs the landfill classification, design, investigation, operation, and monitoring of landfills and regulates where medical waste must be dumped by looking at the waste class and size of the operation.

3. Minimum requirements for the monitoring of Water quality of waste management facilities

This policy addresses the monitoring of water quality in and around waste disposal facilities to make sure that water is clean so that it does not cause health risks.

South African National Standards (SANS)

The SANS 10248-1(2008) regulates how health care waste must be managed from generation, segregation, storage until final disposal. It includes a guide on the training of staff on management of health care waste and ensures that registered health care professionals and non-healthcare professionals are trained on the management of health care waste and contract (SANS 10248-3, 2011).

In 2004, Gauteng, Mpumalanga, North West, and Limpopo provinces came up with regulations for the management of health care risk waste which was guided by national policy on waste management. In Limpopo Province, the following regulations were made: Integrated Strategy and Action plan for sustainable health care risk waste management in Limpopo, Limpopo health care risk waste management regulations 2004, Integrated waste management policy 2006 and Limpopo province air quality management plan 2009.

2.5. Knowledge of health care workers including nurses on medical waste segregation

Health care workers should be knowledgeable regarding waste segregation because improper disposal of waste can have an impact on their health and their immediate environment. Several studies have been done on the knowledge of health care workers regarding medical waste management.

In India, Anand et al (2016) discovered adequate knowledge on biomedical waste management among health care workers but found a lack in some areas. This shows that continuous training on waste management is needed. Again in India at Rawalpindi, Ali, Sadiq, Hussain & Rehman (2019) revealed that nurses had excellent knowledge on biomedical waste management more than doctors and other health care workers. Also in India, Verma, Soni, Kalhan, Nanda, Kumar & Nandan (2020) found that health care workers knew about categories of waste such as segregation and colour coding of medical waste.

Similarly, Pullishery, Panchmal, Siddique & Abraham (2016) established that in India, nurses and doctors had adequate knowledge about the segregation of medical waste. Significantly, nurses had better knowledge about medical waste segregation than doctors. Vallepalli, Rao, Reddy, Sekhar, Gogineni & Deotale (2017) also conducted a study in India among nursing staff and found that they had good knowledge about medical waste management and that they were excelling on colour coding waste. In India again, Sobh, Fakhry & Mohamed (2018) found that nurses had satisfactory knowledge about health care waste management including waste segregation.

In Asia at Madurai, Panneerselvam (2016) reports that nurses revealed high level of knowledge because of sufficient training on waste management. However, another study done in India, Lucknow revealed that knowledge of biomedical waste management among nurses was poor (Gupta, Shukla & Tyagi, 2016). In Ethiopia, health care workers were not knowledgeable about waste segregation because of inadequate training on waste management and lack of provision of annual education on waste management (Mesfin, Worku & Gizaw, 2014). However, in Ethiopia Deress, Hassen, Adane & Tsegaye (2018) health care workers' knowledge about medical waste management was not satisfactory because of lack of access to waste management training.

In Nigeria, Uchechukwu, Babatunde & Anne (2017) reported that most nurses had knowledge about health care waste and had excellent knowledge about waste segregation. This was supported by a study in Thailand among nurses in clinics that revealed adequate knowledge of medical waste management (Akkajit, Romin, & Assawadithalerd, 2020). Muthoni, et al,

2016) found that in Kenya, staff members demonstrated very high level of knowledge about medical waste management. However, in Southeast Nigeria Anozie et al, (2017) reported poor knowledge about standard medical waste management and that nurses were not complying with the waste management procedures because of lack of regular training and updates on occupational safety measures.

In South Africa, Mpumalanga Province, Makhura (2016) found that health care workers had insufficient knowledge on the disposal of medical waste. In Kwazulu Natal, Olaifa, et al (2018) revealed that health care workers had inadequate knowledge but had a good attitude towards waste management. Malebatja (2016) found that health workers had insufficient knowledge about handling and disposing of medical waste in Limpopo province. The study also reported that inadequate training in medical waste management plays a major role in insufficient knowledge.

Table 1: Summary of colour coding that is used in South Africa

Waste	**Waste sub-category**	**Colour coding and International hazard labels**
Human and anatomical waste	Infectious human waste	Red
	Infectious human waste	Orange
	Non-infectious waste	Blue
Infectious non-anatomical waste	None	Red
Sharps	None	Yellow with the words “dander contaminated sharps”
Chemical waste including pharmaceutical waste	Chemical or pharmaceutical waste	Dark green
	Cytotoxic pharmaceutical waste	Dark green
Radioactive waste	None	No colour coding (this means any colour coding can be used as long as it has an appropriatre international radiation hazard symbol).
General waste	None	Black bags or transparent bags are often used

(Geozone Environmental, 2016)

2.6. Practices of nurses regarding medical waste segregation

Some countries have developed generic waste management. For example, HPCSA has developed guidelines for the management of medical waste. Health care centres must provide a storage area for waste and make sure that health care workers have received training on storage and transportation of waste (HPCSA, 2008).

In Pakistan, Ajmal (2017) found that practices of medical waste management among nurses were adequate and that the level of practice was better compared to their level of knowledge. Similarly, in India, Soyam, Hiwarkar, Kawalkar & Gupta (2017) realised that nurses did not just have good knowledge and attitude but had good practices on medical waste management. Notably, practices of health care workers were relatively poor.

However, another study in India, Dhaka city, Jahan (2018) reported that poor practices of medical waste management among health workers was due to poor levels of knowledge and attitude. In Asia, waste management practices among surveyed clinics was poor because all clinics were not following waste management rules of 2005. The absence of proper segregation, storage, transportation, and disposal was commonly encountered. Moreover, a mini-review on health care waste management in Asian developed countries showed failure to practice proper healthcare waste management and a lack in proper waste segregation, collection, safe storage, transportation, and disposal (Khan, Cheng & Ahmed, 2019).

In Kenya, Maina (2018) noted that nurses had good practices on waste management and that all staff members had adequate knowledge. Maina also reported that most staff members were familiar with colour codes used for medical waste segregation. In Botswana, Mugabi et al, (2018) noted that health care workers' practices on medical waste management were above average but an improvement on accessing medical waste disposal points was needed. Wafula, Musiime & Oporia (2019) found that in Uganda, nurses in primary health care facilities had satisfactory practices of waste management because all staff members had received training on management of health care waste.

However, in Nigeria, Awodele et al, (2016) found that there was poor practice of medical waste management in seven hospitals due to lack of policies or guidelines because health care workers were mixing waste. Similarly, Haifete, Justus & Iita (2016) in Namibia practices of medical waste segregation were not effective among health care workers. They recommended that training on medical waste segregation must be done regularly.

In Pretoria, South Africa, Semenya (2016) notes that health care waste was well managed and maintained and the management of waste was practiced according to South African

national and local guidelines as well as WHO's recommended standards. In Limpopo's George Masebe hospital, Malebatja (2016) found that health care workers' management of medical waste was good.

However, in Kwazulu-Natal, Olaifa et al (2018) found waste management was not appropriate and that there was a need for ongoing monitoring of practices at hospitals to ensure best management practices. Olaifa et al also recommended the ensuring that staff and visitors work under a safe working conditions and the reviewing of the training curriculum of health care workers so that policies of health care workers are updated. In South Africa, Olaniyi, Ogola & Tshitangano (2018) reported poor practices of medical waste management from point of generation to disposal and non-compliance to medical waste guidelines.

2.7. Health effects of improper medical waste segregation

The generation of large quantities of waste is a critical issue across the world and it becomes a concern when various types of hazardous waste are mixed up with general waste. WHO (2005) estimated that in the year 2000, needles with contaminated syringes caused 21 million Hepatitis B virus infections (32% of all new infections), two million Hepatitis C virus infections (40% of all new infections), and 260,000 HIV infections (5% of all new infections). During the handling of waste, injuries occur when needles or other sharps have not been collected in rigid puncture-proof containers. Overflow of sharp containers increases the risk exposure of the health care workers to needle stick injuries.

In Ethiopia, the most common treatment methods for hazardous and general wastes are incineration and open burning, incinerators are often operated under sub-optimal conditions and due to inadequate incineration, harmful substances can be released into the environment (Yazie, Tebeje & Chufa, 2019). Also, in Ethiopia, some health centre management showed no concern about healthcare waste management. Some nurses sustained injuries during working hours and there was no registration book for any injury or contamination of infectious waste (Tadesse & Kumie, 2014).

In Indonesia, Insani, Qonita, Jannah, Nuraliyah, Supadm, Gatera, Alfian & Abdulah (2020) found that people were not aware of the dangers and hazardous risks associated with improper management of pharmaceutical waste. In Zimbabwe, Jerie (2016) noted high incidents of muscular-skeletal disorders because solid waste management practices are done manually. Therefore, health hazards associated with this way of waste management include incidents of diarrhoea, viral hepatitis, and higher incidents of obstructive and restrictive disorders.

In South Africa, the challenges of health care risk waste management in Limpopo were identified in two hospitals where there was a major policy implementation gap between the central government and the hospitals. There was no proper segregation of waste according to classifications as required by the national government. The modern practice of incinerators and landfills were not used according to minimum standards and incinerators were not environmentally friendly (Nemathaga et al., 2008).

2.8. Theoretical framework/model

The Knowledge, Attitude, and Practice (KAP) model was used in this study. This model was developed as a tool to investigate what is known, believed, and done by respondents in a specific topic, widely to structure interviews and questionnaires (Vandamme, 2009). Correlation among Knowledge-Attitude-Practice was developed by Schwartz in 1976 on his diet study to find the relation of knowledge, attitude, and practice (Bano, Alshammari, Fatima & AL-Shammari, 2013).

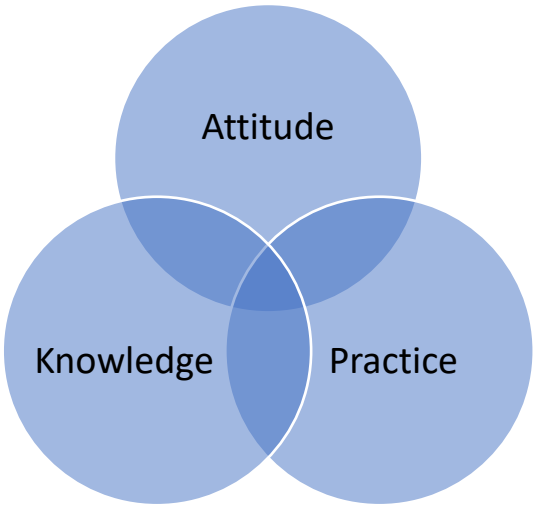

Figure 2: The Knowledge-Attitude-Practice Model (Bano et al, 2013).

Advantage: This model made it easy for the research to be conducted and the results were easily interpreted and had a concise interpretation. It was also useful in describing the current knowledge and practice as it describes knowledge, attitude, practice, problem identification and intervention planning (Vanndamme, 2009).

Limitations: Launiala (2009) argues that the KAP model cannot investigate knowledge in anthropological terms such as culture-specific knowledge of illness or knowledge about the health system. The limitation of this model was that it does not always explain why and how things must be practiced.

Relation to the study: It relates to this study because the study focused on the knowledge and practice of nurses regarding segregation of medical waste. In this model, knowledge refers to participants' understanding of any given topic (Kaliyaperumal, 2004) and practice refers to the way that respondents demonstrate their knowledge (Kaliyaperumal, 2004). It means the application of rules regarding action (Badran, 1995). In other words, it means the application of nurses' knowledge when practicing medical waste segregation.

Application to the study: The KAP model was applied to understand knowledge and practice of nurses on medical waste segregation because it determines the relationship of each factor. It was applied in modifying the questionnaire to acquire information that led to the development of intervention strategies. it helps on how knowledge relates to practice towards medical waste segregation. The results of the study using Pearson's correlation coefficient showed that there is a positive and weak significant relationship between knowledge and practices of nurses on medical waste segregation, r (133) =0.269, $p < 0.002$. This means that there was an association between knowledge and practices of the respondents.

2.9. Chapter summary

This chapter discussed the literature review relevant to this research. The chapter discussed types of medical waste, policies related to medical waste, studies on knowledge and practices of medical waste management, health effects of improper waste management, and the theoretical framework. The next chapter discusses the methodology of the study.

CHAPTER 3

METHODOLOGY

3.1. Introduction

The previous chapter reviewed literature relevant to this research. This chapter describes the research methodology and explains the research methods used to achieve the objectives of the study (Babbie, 2016). The chapter discusses the research approach, study design, study setting, study population, sampling, inclusion criteria, measuring instrument, pre-test, validity, reliability, data collection, data management, data analysis, and ethical considerations.

3.2. Research approach

A research approach is a plan and procedure that involves steps of broad assumption to detailed method of data collection, analysis and interpretation of data (Creswell, 2016). In this study, a quantitative approach was used to describe practices of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province. A quantitative approach was used because it reduces research bias when collecting data as there is no direct contact with the respondents and leads to more reliability. Furthermore, it was used because it gave the researcher a chance to study a total sample with the respondents since all had an equal chance to be part of the study.

3.3. Study Design

A study design is a plan adopted by a researcher when conducting a study (Babbie, 2016). In this study, a cross-sectional study design was used to describe practices of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province. The cross-sectional descriptive study design was used because the researcher wanted to thoroughly describe the specific details about the knowledge and practice of nurses on medical waste segregation. According to Babbie & Mouton (2018), a cross sectional survey is an observational research design that seeks to study a designed population at a given point in time. This study design was also ideal because it helped the researcher to collect a lot of data at one point in a short period whereby a structured questionnaire was distributed to all nurses. Furthermore, it is easy and quick to conduct.

3.4. Study setting

A study setting is an area where a study is conducted (Babbie, 2016). This study was conducted in primary health care centres in Ephraim Mogale Municipality in Sekhukhune District, Limpopo Province in South Africa to describe practices of nurses regarding segregation of medical waste. Sekhukhune District is a rural area in Limpopo Province and is divided into four local municipalities namely: Fetakgomo, also known as Greater Tubatse, Makhuduthamaga, Ephraim Mogale and Elias Motsoaledi. Ephraim Mogale is a category B local municipality and it is the smallest of the four municipalities. The municipality is at the border of Mpumalanga and Limpopo province, it is about 160km from Pretoria to a small complex Marble Hall and about 190km from Polokwane. Ephraim Mogale has 15 primary health care centres and 3 mobile clinics.

Waste containers are supplied by a private company situated in Seshego Polokwane called Buhle Health Care Risk Waste Collectors. They supply health care facilities with all waste containers for segregation, these include sharps containers, vials containers, general infectious waste that includes a pedal bin and a wheely bin that is red in colour, anatomical waste containers that are red in colour and pharmaceutical containers that are green in colour. In this area, medical waste is collected weekly or at least three times a month and staff members order waste containers whenever they see that there is a need.

Figure 3: Sekhukhune District Map showing Ephraim Mogale Municipality

Source: Google map (www.google.co.za/maps/search/Sekhukhune/district)

3.5. Study population

A study population is an entire group of persons or objects that are of interest to the researcher who meet the criteria of a phenomenon that the researcher is studying (Brink et al, 2017). In this study, the population was nurses in primary health care centres in Ephraim Mogale Municipality, Sekhukhune District. The target population included all male and female nurses from the age of 21 years. The study population was 147 nurses composed of 81 professional nurses, 32 staff nurses and 34 assistant nurses. Out of 147 questionnaires, only 133 questionnaires were received back.

3.5.1. Population frame

Table 2: Ephraim Mogale Population frame

Name of Municipality	No. of Professional Nurses	No. of Enrolled Nurses	No. of Enrolled Nurses Assistants	Total no. of population
Ephraim Mogale Municipality	81	32	34	147

3.6. Sampling

Sampling refers to a manageable subset of population that represents an entire population (Creswell, 2018). In this study, a total population sampling was used because the population size was relatively small. Total population sampling refers to the type of purposive sampling where the entire population with a set of characteristics are included in the study (Etikan & Bala, 2016). Since the total population includes all the respondents within the population of interest, it helped the researcher to get a deep understanding of the phenomenon of interest and it reduced the risk of missing potential insights from people who are not included.

3.7. Inclusion criteria

All nurses at the selected health care facilities in Sekhukhune district.

3.8. Measuring instrument

A measuring instrument is used to collect data (Brink et al, 2017). Data was collected through a self-administered questionnaire which developed questions aimed at describing practices of nurses on medical waste segregation. The questionnaire was used because it maintained

privacy for respondents since no personal information was required from them. This instrument was developed and used after a thorough review of literature and pre-existing instruments which were used to assess knowledge and describe practices of nurses on medical waste management. The questionnaire was not translated into other languages spoken in the area as all respondents understand English. The questionnaire had three sections. **Section A** had questions on demographic information. **Section B** had questions on the knowledge of nurses concerning segregation of medical waste. Knowledge scores were allocated and assessed with a scale of 0-49= Poor, 50-74= Good, and 75-100= Excellent **Section C** had questions on the practices of nurses about medical waste segregation and ranking was done using the same scale as knowledge.

3.9. Pre-test

Pre-test is a critical examination of the survey instrument that helps to test the validity and reliability of the research instrument (Babbie, 2016). It is important to test the method to make logistic preparations, define the weakness and to point out parts of corrections. The instrument was pretested at Groblersdal clinic that is within Elias Motswoaledi Local Municipality on 10% of the population which was 15 nurses. This clinic was conveniently selected because nurses share equivalent characteristics because they are in the Sekhukhune District. A pre-test was done two weeks before data collection. The researcher visited the clinic with the approval letters from the Department of Health to seek permission from the clinic manager to conduct a pre-test. An appointment was made with the manager before the pre-test was done and then arrangement was done with nurses. Lunchtime was used for the pre-test to avoid interrupting nurses' official duties. A structured questionnaire was given to the respondents together with the consent form and they were requested to put it in a box that was provided to them after completing the questionnaire. The pre-test was not done in Ephraim Mogale Local Municipality clinics to avoid biased information since total population sampling was used.

3.10. Validity

Validity is the degree to which an instrument measures what it is supposed to measure (Robinson, 2014). Face and content validity was used in this study. Face validity was ensured by sending the questionnaire to experts for evaluation of face value. These experts included supervisors, University statistician, departmental staff members, and the University Higher Degrees Committee members. The researcher ensured content validity by submitting the questionnaire to the University statistician and supervisors in the Department of Public Health for comments and inputs to scrutinise ambiguous language or difficulties so that it could be corrected. The questions on the questionnaire were phrased appropriately to ensure that the

questionnaire measured what it was intended to measure. The respondents were given a chance to go through the questionnaire while the researcher was around to clear any misunderstanding.

3.11. Reliability

Reliability refers to the consistency, accuracy and precision of the instrument measurement (Lane, 2013). A re-test was used to check the consistency of the instrument. A re-test was done at Groblersdal clinic on 10% of the population made up of 15 nurses. The researcher administered the questionnaire twice to the respondents and then the correlation coefficient calculations were used to compare the first response with the second response. The instrument has low reliability if the correlation coefficient is close to zero and the instrument is then supposed to be amended until it is more understandable by refining wording until the correlation coefficient is high. In this re-test, the correlation coefficient was close to one and that means the instrument had high reliability (Creswell, 2009). To avoid nurses from memorising the questionnaire, the period between re-test was two weeks.

3.12. Data collection

Data collection is the gathering of information relevant to the research purpose and questions of the study (Burns & Grove, 2013). The researcher was delayed from immediately collecting data after the approval letter from the district office because of the country's lockdown Level 5 in March 2020. But thereafter, with the approval letter from the Department of Health and the Sekhukhune District, the researcher contacted clinic managers telephonically, and where possible, visited them at their clinics to seek permission for conducting the study. After obtaining permission from the clinic managers, the researcher gave managers the exact date of data collection so that they could arrange with the nurses. The researcher used a structured questionnaire to collect data from the nurses where it was personally distributed to all nurses. The researcher collected data herself in June/July 2020 during the COVID-19 pandemic from all the clinics on different times and dates. All measures to prevent the spread of Covid-19 were followed during data collection. Data was collected at the clinics where nurses are working. The researcher asked for one cubicle or a free space from the manager. On the appointed date of data collection, the researcher went to the clinics before lunchtime to collect data on lunchtime. During this time, respondents were given a consent form to go through so that they could sign before the commencement of data collection. Respondents were given a structured questionnaire which took approximately 45 minutes to complete. After completing

the questionnaires, they were requested to put them inside a small box that was provided for the purpose.

3.13. Data management and analysis

Data analysis is the process of evaluating data which leads to categorising, ordering, manipulating, summarising and describing data in a meaningful way (Brink et al, 2017). A software that was used is the Statistical Package for Social Science (SPSS) version 26. Descriptive statistics which contain mean, standard deviation, and frequencies were used to analyse data. A Chi-square test was used to establish if there was a relationship between variables of interest. An evaluation of the relationship between knowledge and practices of nurses on medical waste segregation was measured using Pearson's Correlation. The data was cleaned and graphs and tables were used to present it.

3.14. Ethical considerations

Ethical consideration involves protecting the rights of the respondents and institutions where research is done and maintaining science integrity (Babbie, 2016). Ethical considerations were ensured throughout the study to protect the rights of the respondents and institution. The researcher sought permission to conduct the study. Informed consent, voluntary participation, confidentiality, privacy, and protection of the respondents from any harm were considered.

Department of Public Health and School of Health Sciences presentations

The researcher presented a research proposal to the Department of Public Health and School of Health Sciences at the University of Venda for quality assessment.

Ethical Clearance

A copy of the research proposal was sent to the University Higher Degrees Committee to seek permission to conduct the study. With the approval letter from the University Higher Degrees Committee, the researcher applied for ethical clearance to the Research Ethics Committee of the University of Venda to seek permission to conduct the study. An ethical clearance letter was granted from the Research ethics committee, University of Venda as *Project no: SHS/19PH/26/2410*.

Seeking permission from the Department of Health and Sekhukhune District

A copy of the research proposal together with a copy of ethical clearance and a written letter were sent to the Department of Health Provincial Office and to Sekhukhune District of Health to seek permission to conduct the study and permission was granted.

Protecting the rights of the respondents

The principle of beneficence: Respondents were informed about the harms and benefits of the study; they were told that the benefit of the study was to improve medical waste management in their clinics and there was no anticipated harm in the study.

The principle of justice: All respondents meeting the criteria were afforded a chance to participate and to benefit from the study.

Confidentiality and anonymity: Information obtained during the research was not disclosed to anyone and was kept in a safe place where no one had access to obtain it. Anonymity was provided by ensuring the respondents' specific responses and information were not linked in any way to them. No information, including names and addresses of the participant were mentioned during the publication of any information obtained from the interview. Respondents were given a code to replace their names to avoid disclosure of their identity and prevent harm to them.

Privacy The researcher ensured privacy by conducting data collection inside cubicles where participants were comfortable and information from the participant was not shared without the individual's knowledge or against her will. Respondents were assured that the data they provided would be kept in a safe place.

Informed consent: A full explanation was given to the participants on how the research was to be conducted. Participants were informed that participation is voluntary and that data would be disseminated through a research report. They were informed that they had a right to withdraw from the study at any time if they were no longer interested or if they felt that they were being requested to do something that made them uncomfortable or something that was not written in the consent forms.

Termination: Respondents were allowed to terminate at any stage if the project was no longer adhering to the standard formulated.

Protecting the rights of the institution

Protection of the institution was maintained by obtaining permission from the head of the institution before conducting the study. Information about the institution was kept confidential by keeping the questionnaires in a safe place to prevent unauthorised access. Respondents were advised not to write the name of the institution when completing the questionnaires.

3.15. Summary of the chapter

This chapter discussed the study's methodology. A quantitative approach was used because it reduces the likelihood of the research being biased. A cross-sectional study design was used to describe practices of nurses about the management and segregation of medical waste. Study setting, population, sampling, inclusion criteria, techniques of data collection, and data analysis were discussed. The next chapter interprets the study results.

CHAPTER 4

ANALYSIS AND PRESENTATION OF DATA

4.1. Introduction

The previous chapter discussed the methodology of the study. This chapter explains the findings of the collected data and data analysis on the responses in the completed questionnaires about practices of nurses on medical waste segregation in selected health care facilities in Sekhukhune District, Limpopo Province. Data was analysed using IBM SPSS statistics. Results are presented in frequencies and percentages in tables, charts and graphs. Chi-square was done to present the relationship between the variables.

4.2. Socio-Demographical Information

4.2.1 Gender

Table 3: Frequency and percentage distribution of nurses by gender

GENDER	FREQUENCY	PERCENTAGE
Male	15	11.3 %
Female	118	88.7 %

Results in Table 3 shows that there were 188 (88. 7%) female nurses and 15 (11.3%) male nurses who responded to the questionnaires.

4.2.2. Age

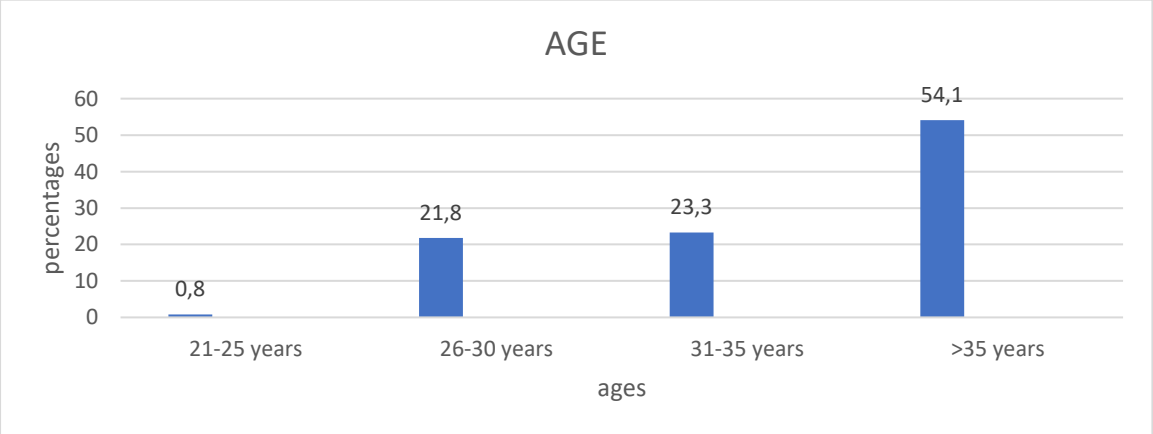

Figure 4: Percentages of nurses by age group

Figure 4 shows that 54.1% of nurses were above 35 years, 23.3% were between 31 and 34 years followed by 21.8% between 26 and 30 years and then 0.8% who were between 21 and 25 years.

4.2.3. Professional category

Table 4: Table showing frequency and percentage distribution of professional category

Professional Category	Frequency	Percentage
Professional nurses	93	70 %
Staff nurses	14	10.5 %
Assistant nurses	26	19.5 %

Table 4 shows that 70% were professional nurses, 19.5% assistant nurses and 10.5% staff nurses.

4.2.4. Years of experience

Figure 5: Percentages of nurses' years of work experience

Figure 5 shows that 27% of nurses had less than 5 years of work experience, 25.6% were in the 16-20 years' range, 22.6% were within 6-10 years, 15% were within 11-15 years, and lastly 11% had more than 20 years of work experience.

4.3. Knowledge of nurses on medical waste segregation

Table 5: Knowledge of nurses on medical waste segregation

Statement	Scale	frequency	percentages
Personal protective equipment is used routinely when handling medical waste.			
	Disagree	10	7.5%
	Neutral	4	3%
	Agree	119	89.5%
Placing medical waste in the wrong bin is a high risk.			
	Disagree	1	0.8%
	Neutral	4	3%
	Agree	128	96.2%
I know of policy documents regarding adequate disposal procedures of human tissue remains.			
	Disagree	4	3%
	Neutral	19	14.3%
	Agree	110	82.7%
Throwing human tissue remains in domestic waste is an adequate disposal procedure.			
	Disagree	90	67.7%
	Neutral	14	10.5%
	Agree	29	21.8%
It is necessary to sort medical waste at the point of generation.			
	Disagree	10	7.5%
	Neutral	1	0.8%
	agree	122	91.7%
Used dressings, cotton, and plasters are considered medical waste according to medical waste classification			
	disagree	3	2.3%
	Neutral	3	2.3%
	Agree	127	95.4%
Used cotton, webcols, and gauzes are classified as medical waste.			
	Disagree	4	3%
	Neutral	0	0%
	Agree	129	97%
Improper waste disposal can lead to needle stick injuries.			
	Disagree	5	3.8%
	Neutral	0	0%
	Agree	128	96.2%
The colour code for disposal of human tissues, anatomical and any infectious waste is yellow as per guidelines for waste management.			
	Disagree	46	34.6%
	Neutral	15	11.3%
	Agree	72	54.1%

The colour code for microbiological waste is red as per guidelines for waste management.			
	Disagree	16	12%
	Neutral	13	10%
	Agree	104	78%
Any waste mixed with medical waste must be treated as medical waste.			
	Disagree	15	11.3%
	Neutral	8	6%
	Agree	110	82.7%
Improper waste disposal may lead to the transmission of diseases.			
	Disagree	3	2.3%
	Neutral	3	2.3%
	Agree	127	95.4%

For reporting, strongly disagree was combined with disagree and Strongly Agree was combined with Agree. This was collapsed into disagree, neutral and agree. Out of 133 respondents, most respondents (97%) agreed that used cotton, webcols and gauzes were classified as medical waste whilst 3% did not agree. Most (96.2%) respondents were in favour of placing medical waste in the wrong bin while three percent of the respondents disagreed. More than three quarters (96.2%) of the respondents agreed that improper waste disposal can lead to needle stick injuries while 3.8% disagreed. About 95.4% of respondents agreed that used dressings, cotton, and plasters are considered medical waste according to medical waste classification and that improper waste disposal may lead to transmission of diseases as opposed to 2.3% who disagreed. Most (91.7%; n=122) respondents agreed that it is necessary to sort medical waste at the point of generation as compared to 7.5% of the respondents who disagreed.

About 89.5% of respondents agreed that personal protective equipment is used routinely when handling medical waste segregation while 7.5% of respondents disagreed with the statement. About 82.7% of respondents agreed that they knew of policy documents regarding adequate disposal procedures of human tissue remains compared to 14.3% who were not sure. Another 82.7% of respondents agreed that any waste mixed with medical waste must be treated as medical waste, but 11.3% of respondents disagreed with the statement.

Results also showed that 78% of respondents agreed that the colour code for microbiological waste is red as per guidelines for waste management. About 67.7% respondents disagreed that throwing human tissue remains in domestic waste is an adequate disposal procedure, 21.8% agreed and 54.1% of respondents agreed that the colour code for disposal of human, biological, and any infectious object that has been in contact with body fluids is yellow as per guidelines for waste management and 34.6% of respondents disagreed.

4.3.1. Percentages of nurses' knowledge on medical waste segregation

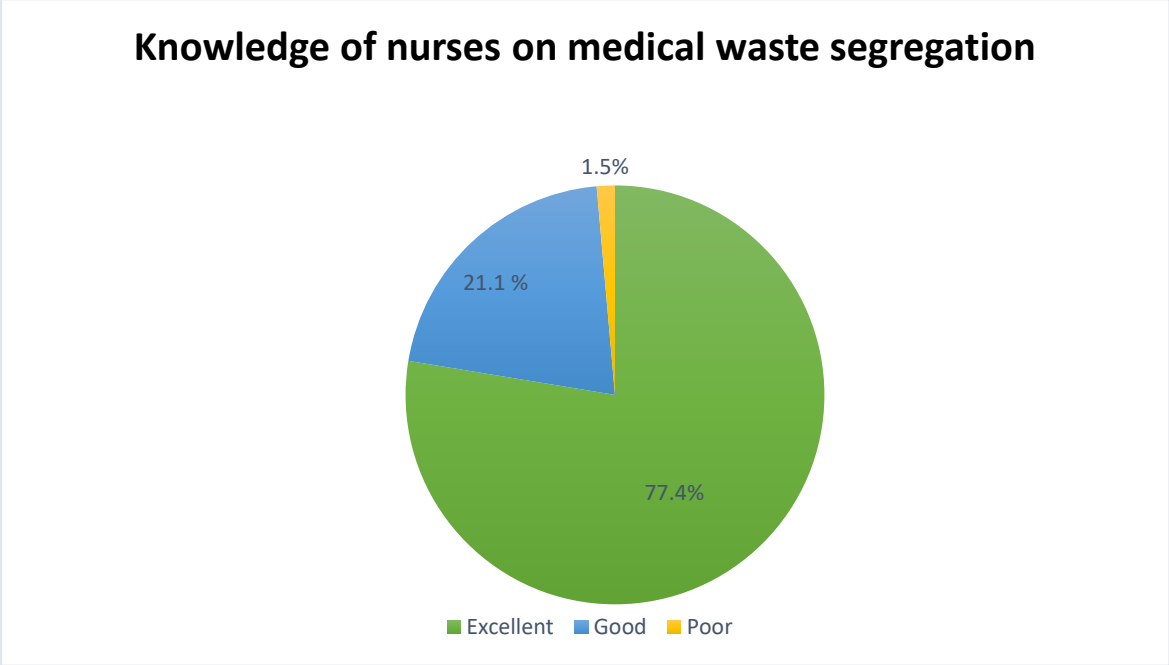

Figure 6: A chart showing percentages of nurses' knowledge

Figure 6 depicts that 77.4% of the respondents had excellent knowledge, as compared to 1.5% who had inadequate knowledge regarding medical waste segregation.

4.4. Practices of nurses on medical waste segregation

Table 6: Table showing practices of nurses on medical waste segregation

Statement	Scale	Frequency	Percentage
I always use gloves when handling medical waste.			
	Disagree	5	3.8%
	Neutral	0	0%
	Agree	128	96.2%
I always observe colour coding used for segregating medical waste during waste disposal.			
	Disagree	3	2.3%
	Neutral	7	5.3%
	Agree	123	92.4%
I dispose of the liquid waste in bags that prevent leakage.			
	Disagree	15	11.2%
	Neutral	13	9.8%
	Agree	105	79%

I discard empty packets and bottles of medication in infectious waste bins.			
	Disagree	76	57.1%
	Neutral	9	6.8%
	agree	48	36.1%
I discard used ampules in a vial container.			
	Disagree	15	11.3%
	Neutral	4	3%
	Agree	114	85.7%
I discard pipette with a glass in a sharp container.			
	Disagree	8	6%
	Neutral	12	9%
	Agree	113	85%
A used needle must not be recapped.			
	Disagree	5	3.8%
	Not sure	1	0.8%
	Agree	127	95.4%
I discard used needles immediately after use.			
	Disagree	16	12%
	Neutral	3	2.3%
	Agree	114	85.7%
I discard used needles in a designated sharp container.			
	Disagree	1	0.8%
	Neutral	0	0%
	Agree	132	99.2%
I report needle stick injury to the Occupational Health Nurse whenever it occurs to me.			
	Disagree	3	2.3%
	Neutral	2	1.5%
	Agree	129	96.2%
Medical waste containers are replaced when they are ¾ full.			
	Disagree	39	29.3%
	Neutral	3	2.3%
	Agree	91	68.4%
Medical waste containers are replaced after 3 months though they are not ¾ full.			
	Disagree	54	40.6%
	Neutral	20	15%
	agree	59	44.4%

Medical waste containers are labeled with a date of first use.			
	Disagree	52	39.1%
	Neutral	6	4.5%
	Agree	75	56.4%
Personal protective equipment is always available.			
	Disagree	48	36.1%
	Neutral	14	10.5%
	Agree	71	53.4%
Waste monitoring inspections are conducted on monthly basis.			
	Disagree	68	51.1%
	Neutral	14	10.5%
	Agree	51	38.4%
A temporary waste storage area is available in the clinics.			
	Disagree	11	8.3 %
	Neutral	6	4.5%
	Agree	116	87.2%

Most respondents agreed that they discard used needles in a designated sharp container (99.2%; n=132) and report needle stick injury (96.2%) to the occupational health nurse whenever it occurs. This was followed by another 96.2% of respondents who agreed that they always use gloves when handling medical waste segregation as compared to 3.8% who disagreed. About 95.4% of respondents agreed that used needles must not be recapped, also, 92.4% agreed that they always observe colour coding used for segregating medical waste during waste disposal as compared to 3,8% and 2.3% who disagreed.

About 85.7% of respondents agreed that they discard used ampules in a vial container while 11.3% of respondents disagreed. Another 85.7% of respondents agreed that they discard needles immediately after use whilst 12% of respondents disagreed. About 87.2% of respondents agreed that temporary waste storage is available in their clinics and 4.5% were not sure. Eighty-five percent of respondents agreed that they discard pipette with a glass in a sharp container whereas 6% disagreed.

The study results showed that 79% of respondents agreed that they dispose of the liquid waste in bags that prevent leakage. More than half (68.4%) of the respondents agreed that medical waste containers are replaced when they are ¾ full as opposed to 29.3% of respondents. About 57.1% of the respondents disagreed that they discard empty packets and bottles of medication in infectious waste bins while 36.1% of respondents agreed. Results also showed that 56.4% of respondents agreed that medical waste containers were labelled with a date of

first use whereas 39.1% of respondents disagreed. Over half (53.4%) of the respondents agreed that personal protective equipment was always available whereas 36.1% did not agree. About half of the respondents (51.1%) disagreed that waste monitoring inspections were conducted on monthly basis as opposed to less than half (38.4%) who agreed. Less than half of respondents (44.4%) agreed that medical waste containers are replaced after 3 months though they may not be ¾ full while 40.6% of the respondents disagreed

4.4.1. Percentages of nurses' practices on medical waste segregation

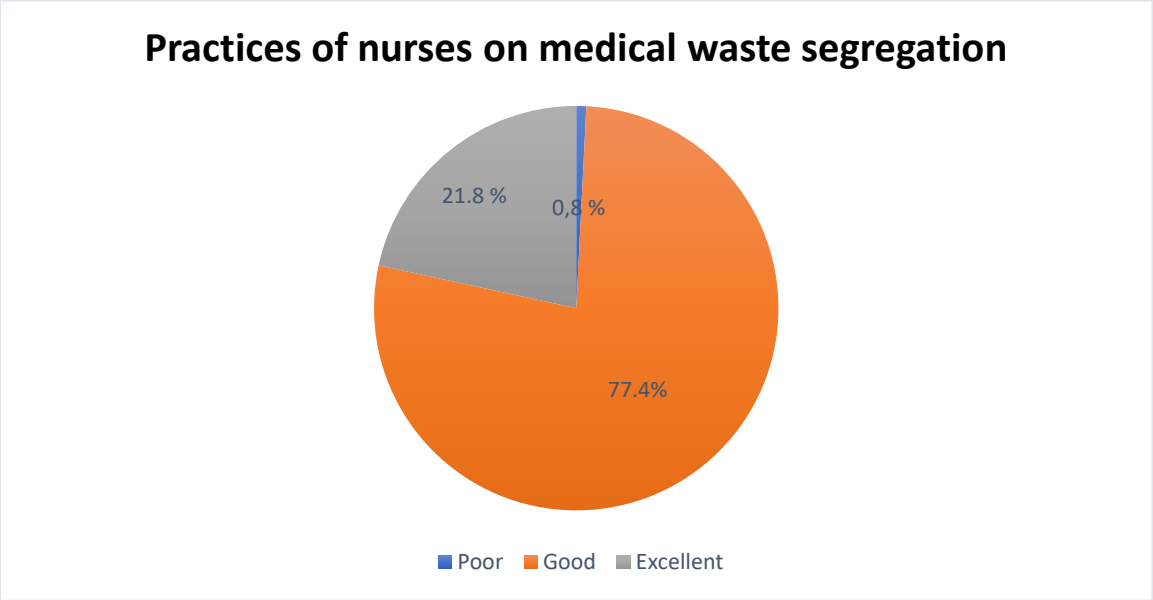

Figure 7: Chart showing nurses practices on medical waste segregation

Figure 7 shows that 77.4% have excellent practices on medical waste segregation while 0.8% showed poor practice.

4.5. Relationship between practice and knowledge of nurses regarding medical waste segregation.

Table 7: Showing correlation between knowledge and practice of nurses

		Knowledge	Practices
Knowledge	Pearson Correlation	1	.269**
	Sig. (2-tailed)		.002
	N	133	133
Practices	Pearson Correlation	.269**	1
	Sig. (2-tailed)	.002	
	N	133	133

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

Table 6 shows the strength of the relationship between knowledge and practices of nurses on medical waste segregation. An analysis using Pearson's correlation coefficient indicated that there is a positive and weak significant relationship between knowledge and practices on medical waste segregation, r (133) =0.269, $p < 0.002$.

4.6. Chapter summary

This chapter presented the results obtained from data collected from nurses about their practices regarding medical waste segregation. The next chapter discusses the study results.

CHAPTER 5

DISCUSSION OF RESULTS

5.1. Introduction

The previous chapter presented the study results. This chapter discusses the results that were found about the practices of nurses regarding medical waste segregation in Sekhukhune District.

5.2. Socio-demographic characteristics of the respondents

This study showed that the majority of the respondents were females and most of the respondents were in the age group above 35 years. similar findings were reported by other researchers. In Egypt, Sobh et al, (2018) showed that females (93.6%) were the dominant gender in the study. In Nigeria, Uchechukwu et al, (2017) majority respondents (52.2%) on health care waste management showed were females. A similar trend was noted in South Africa by Makhura (2016) who reported that 80.9% of his respondents on medical waste management were females. However, in a study conducted in Ethiopia, most respondents (67.1%) were males (Sahiledengle, 2019). The World Health Organization (WHO) statistics for 2015 indicate that most health care workers are females comprising over 75% of the health sector workforce in many countries.

The study further showed that most of the respondents were in the age group above 35 years. Similar findings were found in a Bangladesh hospital where most of the respondents (45.6%) were above 35 years (Uddin, Islam & Yesmin, 2014). In South Africa, Olaifa et al, (2018) also reported most health care workers' respondents (84%) were above 35 years. This can be a result that the South African Nursing Council (SANC) age distribution statistics for 2019 indicate that the majority of nurses (94%) are in the age group above 35 years. However, in Asia, Dhaka City, Jahan et al, (2018) reported different findings with the majority of their respondents (28.6%) being in the age group of 31 - 35 years.

Concerning total years of experience, most respondents in this study were in the age range of 0-5 years. This collaborates with findings reported among nurses in Bangladesh where most respondents (76.7%) were within the age range of 0-5 years of experience (Panneerselvam, 2016). However, in Botswana, Mugabi et al, (2018) reported that most respondents have worked in the hospital for less than 10 years. This can be a result of young nurses who are newly appointed from universities and colleges to the clinics.

5.3. Knowledge of nurses regarding medical waste segregation

The study findings showed that three quarters of the respondents had good knowledge regarding medical waste segregation. Similar findings were reported in Madurai regarding knowledge about medical waste management where 77.6% respondents had adequate knowledge (Panneerselvam, 2016). In Pakistan, 61.2% nurses had excellent knowledge of biomedical waste management (Ali et al, 2019). Similar findings were reported by Awodele et al (2016) in Nigeria and Makhura (2016) in South Africa who reported that most nurses had adequate knowledge of medical waste management (95.8%) and medical waste segregation (47.2%) respectively. The current study contrast with other South African study findings as reported by Olaifa et al (2018) who revealed that at 42.7%, health care workers had inadequate knowledge on medical waste management. The difference might be due to the utilization and availability of health care waste management guidelines and the provision of training opportunities for health care workers in different countries.

This study showed that respondents knew that used cotton, webcols, and gauzes are classified as medical waste. This correlates with findings in India where most respondents were discarding used gauzes in a proper way (Jahan et al, 2018). However, in Lucknow, most nurses discarded used gauzes in black plastic which is not a proper way of disposing them (Gupta, et al 2016). This difference might be due to the fact that some of the health care workers were not knowledgeable that used cotton, webcols and gauzes are considered as medical waste.

This study showed that nurses were knowledgeable that improper waste disposal lead to needle stick injuries. Similar findings were found in Namibia where 100% of nurses and doctors knew how to handle used syringes and needles and understood that if incorrectly segregated can lead to needle stick injuries (Haifete et al, 2016). This study further showed that nurses knew that improper disposal of waste can lead to transmission of diseases. Similarly, in Kenya, most respondents (95.4%) were aware that improperly managed waste can lead to transmission of disease (Maina, 2018). However, a study on medical waste segregation among nurses in Nigeria revealed lower results compared to the current study in that 66.7% of nurses were aware of the hazardous effects of improper medical waste disposal (Adogu, Ubajaka & Nebuwa, 2014). High percentages of the knowledgeable participants on this could be a result of reported needle stick injuries and transmission of diseases such as HIV /AIDS and Hepatitis through improper management of waste in their facilities.

Segregating waste immediately after use is important as it prevents infections and injuries. It was revealed in this study that nurses had knowledge on the importance of sorting medical

waste at the point of generation. Muthoni at al (2016) found similar results in Kenya where 80% of the respondents agreed on the need to separate medical waste at the source. Similar findings were also reported in Bangladesh by Johan et al (2018) that biomedical waste should be segregated as it is dangerous. This can be a result of nurses knowing that medical waste segregation at the source is an ideal situation.

Most of the nurses in this study were knowledgeable that personal protective equipment should be used routinely when handling medical waste. This agrees with a study in India, Rawalpindi in which reported 86.21% of personal protective equipment usage among nurses (Ali et al, 2019). Similarly, in Cameron the knowledge about the use of personal protective equipment among waste handlers was high at 100% (Dzekashu, Akoachere & Mbacham, 2016). However, in Malaysia, Khanehzaei, BakriIshak, Manaf & Abdullah (2014) observed inadequate knowledge about the use of personal protective gear among nurses. Where there is excellent knowledge about the use of personal protective gear it could be due to in-service training received by health care workers from their seniors. For example, in Pakistan, Kumar et al, (2015) established that intensive training improves knowledge among health care workers.

The findings of this study also showed that most nurses were aware of policy documents regarding adequate disposal procedures of human tissue remains. This can be attributed to the fact that many health facilities are provided with policy documents. In Nigeria, Uchechukwu et al, (2017) showed that only 42.6% of health care workers were aware of the legislation and policies of medical waste disposal. However, in Uganda, Muhwezi, Kaweesa, Kiberu & Eiyoku (2014) reported that 6 out of 8 respondents were not aware of document on policies and guidelines. The poor knowledge of policies and guidelines of adequate disposal could be due to the absence of national and provincial policies in health care facilities (Olaniyi et al, 2018).

Less than half of the study respondents were knowledgeable that colour code for disposal of human tissues, anatomical and any infectious human waste is not yellow as per guidelines for waste management. Similar results were reported in Bangladesh that knowledge about colour coding of bins was inadequate at 46,4% and 18% respectively (Uddin et al, 2014; Bhatt et al,2020). However, knowledge on colour coding was higher among nurses in Mangalore at 72.3% as reported by Pullishery et al, (2016). Lack of knowledge on the colour coding is attributed to a yellow pedal bin that is used to put a red plastic inside.

5.4. Practices of health care workers regarding medical waste segregation

This study showed that the nursing practices in relation to medical waste segregation was excellent as 77% was reported by respondents. These achievement is fundamental in the

reduction of needle prick injuries and management of health care risk waste in the facility. Similarly, in Rawalpindi, most nurses (89.6%) had satisfactory practices in this regard (Ali et al 2020). Also, in Port Said 81.8% of the staff nurses had adequate practice in place regarding medical waste segregation (Sobh et al, 2018). By contrast, in South Africa, in the Mpumalanga Province, only 49.6% of health care workers observed medical waste segregation (Malebatja, 2016). Also in a hospital in Ethiopia, only 42.3% of the health care workers reported segregating medical waste (Doylo, Alemayehu & Baraki, 2018). Similarly, in South Africa Olaniyi et al, (2018) reported poor practices of medical waste across the country from the point of generation to disposal. Also, in Nigeria, the Bio-Medical waste revealed that most respondents (72.2%) did not properly segregate medical waste (Anozi et al, 2017). By contrast, in the current study, respondents practised good medical waste segregation. Most respondents (99.2%) said that they discard needles in designated sharp containers. Several studies concur with the current study that most health care workers; for example, Thailand (96.3%); India (93%) and Lucknow in Australia (80%) dispose their sharps in the puncture-proof containers (Gupta et al, 2016; Mehta, Shah& Tiwari, 2018; Akkajit et al, 2020). This can be attributed to the fact that nurses are aware that mishandling needles can lead to needle stick injuries and transmission of HIV/AIDS, tetanus and Hepatitis.

This study revealed that majority of nurses were excelling on wearing gloves when handling medical waste and this helps them to be less prone to infectious diseases. Similar findings were reported in Tanzania (96%); Nigeria (95.7%) and Ethiopia (93%). Studies further confirm that health workers had excellent practice of wearing gloves when handling medical waste (Muluken, Haimanot & Mesafint, 2014; Uchechukwu et al, 2017; Akkajit et al, 2020). Health care workers wear gloves because they are aware that this is an effective way of preventing cross infections. In the case of the current study, respondents were extra sensitive to wearing protective clothing due to the outbreak of COVID-19 pandemic during the time data was collected. However, practices of wearing gloves in Delhi were lower 87.8% compared to other studies (Soyam et al, 2017).

This study showed that most of the nurses were not recapping needles after use. This was supported by a study done in India on the management of waste in a teaching institution showing higher results of respondents (100%) who were not recapping needles (Anand et al, 2016). However, in Ethiopia, most nurses (91%) admitted to recapping needles (Doylo et al, 2018). These health care workers are ignorant that recapping needles can lead to needle stick injuries that can expose them to the transmission of diseases such as HIV/AIDS.

This study revealed that at least more than half of respondents were labelling medical waste containers with the date of first use meaning that there are still certain percentages of nurses

who are not labelling medical waste containers. Similarly, in Ethiopia, Deress et al (2018) found that 78.4% of nurses thought that there is no need of labelling containers. Unfortunately, this exposes them to infections by unwittingly keeping medical waste.

5.5. Relationship between practice and knowledge of nurses regarding medical waste segregation

The results of the study showed that there is a positive and weak significant relationship between knowledge and practice, $p< 0.002$. In this study a positive relationship means that there was an association between knowledge and practices in that adequate knowledge of participants was associated with good practices of the respondents and inadequate knowledge was associated with poor practice. This study revealed that nurses with adequate knowledge practiced medical waste segregation better compared to nurses with inadequate knowledge. This was also supported by nurses who had adequate knowledge on the importance of sorting medical waste at source showing adequate practices on that used needles must be discarded immediately after use. In India, Vallepalli et al, (2017) found a statistically significant correlation between the scores of nurse's knowledge and practices. In Port Said, Sohb et al, (2018) reported that health care workers showed satisfactory knowledge and adequate practices on waste management. Similar results were also reported by Soyam et al (2017) in India, Delhi where it was found that nurses who possess good knowledge, practice medical waste better than those who had poor knowledge.

In Kenya, Maina (2018) found that there was a statistically significant relationship between training received on medical waste management and practices. In Kwazulu Natal, Olaifa et al, (2018) reported that health care workers showed a significant relationship between knowledge and practice ($p<0.05$) but a weak statistically relationship between attitude and practices. Similarly, in Mpumalanga, Makhura (2016) established an association between knowledge and practice with $p=0.000$ among health workers. However, in the Waterberg District in Limpopo Province, Malebatja (2016) found no relationship between the knowledge and practices of health care workers on medical waste disposal.

5.6. Chapter summary

This chapter discussed the socio-demographic information of the respondents such as gender, age, professional category, and years of experience. It further discussed the knowledge and practices of nurses regarding medical waste segregation and the relationship between knowledge and practice. The next chapter provides the conclusion and recommendations for the study.

CHAPTER 6

SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

6.1. Introduction

The previous chapter discussed the study results comparing them with other studies. This chapter provides the conclusion and recommendations based on the findings presented and discussed in the previous chapters.

6.2. Summary of the study

This study described the practices of nurses on medical waste segregation in South Africa, Limpopo Province, Sekhukhune District. The practices of nurses on medical waste segregation were described. A literature review provided detailed information about previous studies on the topic and identified a gap in knowledge which the current study subsequently tried to fill. Results of this study were compared to those of previous studies. The objectives of the study were:

- To assess the knowledge of nurses on segregation of medical waste at selected health care facilities in Limpopo province.

This objective was achieved by using a quantitative approach and cross-sectional study design with total population sampling. Data was collected from the respondents through a structured questionnaire in section B and validity and reliability were ensured. Data was captured and analysed using SPSS version 26 and descriptive statistics which contain mean, standard deviation, and frequencies were used to analyse data in order to assess the knowledge of nurses on medical waste segregation. Knowledge scores were allocated and assessed with a scale of 0-49= Poor, 50-74= Good, and 75-100= Excellent. Results showed that nurses in Sekhukhune District, Ephraim Mogale sub-district have excellent knowledge (77.4%) on medical waste segregation.

With that excellent knowledge, it was so interesting to reveal that nurses were very much knowledgeable that improper waste disposal can lead to needle stick injuries and transmission of diseases. It was revealed in this study that nurses had knowledge on the importance of sorting medical waste at the point of generation and knew that used cotton, webcols, and gauzes are classified as medical waste. In infection control, personal protective equipment is the most important tool in minimising infections at workplace, therefore it was a pleasure to

reveal that majority of nurses knew that personal protective equipment must be used routinely when handling medical waste. However, even though knowledge was excellent, nurses were still lacking knowledge on colour coding because it was revealed in the study that nurses were still mixing waste.

- To describe the practice of nurses' segregation of medical waste at selected health care facilities in Limpopo province.

This objective was also achieved by using a quantitative approach and cross-sectional study design using a total population sampling. Data was collected from the respondents through a structured questionnaire in section C. Data was captured and analysed using SPSS version 26 and descriptive statistics which contain mean, standard deviation, and frequencies were used to analyse data in order to describe practices of nurses on medical waste segregation. Ranking was done using the same scale as knowledge. Ethical considerations were ensured in managing and analysing data. Results showed that nurses in Sekhukhune District, Ephraim Mogale sub-district have excellent practice (77.4%) on medical waste segregation. These results also revealed that nurses were less prone to infections because they were excelling on wearing gloves at all times when handling medical waste and they were not recapping needles after use. However, they revealed poor practices on discarding vials and sharps. Nurses were not certain about where to discard empty packets and bottles of medication and they were poorly labelling waste containers with the date of first use, replacement of containers when they are ¾ full, not certain if they should replace waste containers after three months even when they are not ¾ full and they were poorly practicing monthly waste monitoring inspection in their facilities.

- To determine the relationship between knowledge and practices of nurses on medical waste segregation at selected health care facilities in Limpopo province.

In order to achieve this objective, A Chi-square test was used to establish the relationship between knowledge and practices and Pearson's correlation was used to evaluate the relationship between knowledge and practices of nurses on medical waste segregation. The results of the study showed that there is a positive and weak significant relationship between knowledge and practice, $p< 0.002$.

6.3. Limitation of the study

The study was conducted at Ephraim Mogale Local Municipality out of four municipalities that are in Sekhukhune District. The smallest municipality was selected for the study because that is where the problem was observed.

6.4. Recommendations

Based on the results and conclusion of the study, the following recommendations are made:

6.4.1. Recommendations for knowledge and practice:

- Training on medical waste management must be done frequently to increase the existing knowledge and practice.
- In-service training must be done in the whole sub-district of Ephraim Mogale so that nurses can have the same knowledge and practice.
- Workshops on waste management must be done regularly by Buhle Waste so that nurses can practice one thing and know what they are expected to do in segregating, labelling and replacing of medical waste containers.
- A waste management committee must be created in all clinics to conduct waste management inspections regularly to identify areas that need interventions.
- It is recommended that the Department of Health provides all facilities with the available policies and regulations on medical waste management.

6.4.2. Recommendations for future studies:

- Further studies must be conducted to describe the attitudes of nurses on medical waste segregation.
- In depth studies should be done to explore factors affecting the compliance of medical waste segregation.
- A qualitative study must be done to explore knowledge, attitude and practice of nurses on medical waste segregation.

6.5. Conclusions

This study sought to describe practices of nurses regarding medical waste segregation. The study results show that nurses in Limpopo Province, Sekhukhune District, Ephraim Mogale sub-district, are knowledgeable about and practice medical waste segregation. However, they lack knowledge regarding colour coding and do not label and replace medical waste

containers. Future studies must be conducted to describe the attitudes of nurses on medical waste segregation, to explore factors affecting the compliance of medical waste segregation and also to explore knowledge, attitudes and practices of nurses on medical waste segregation.

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APPENDIX A: LETTER OF INFORMATION

UNIVEN INFORMED CONSENT

LETTER OF INFORMATION

Title of the Research Study: Practices of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province.

Principal Investigator/s/ researcher: Marubini M

Co-Investigator/s/supervisor/s: Dr Luhalima T.R and Mrs Tshivhase S.E

Brief Introduction and Purpose of the Study: Nurses protect and restore the health of the community and that of environment in which they work. Resultantly, medical waste is produced when nurses carry out these health activities. Proper management of waste produced during health care workers' activities is of concern since it can cause potential environmental hazards and public health care risk. According to WHO (2018), every year, an estimated 16 billion injections are administered worldwide but not all these needles and syringes are properly disposed. Therefore, this study seeks to describe practices of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province of South Africa.

Outline of the Procedure: Lunch time will be used to collect data because it is a convenient time for a researcher not to interrupt respondents on duty. Respondents will be given a consent form to go through so that they can sign it before answering the questionnaire. Kindly note that participation is voluntary. A structured questionnaire will be given to you to answer the questions asked and it will last for approximately 45 minutes. After completing the questionnaire, you are requested to put it inside the provided small box.

Risks or Discomforts to the Participant: There will be no risks involved in this study, respondents will be safe throughout the study.

Benefits: The study may add to the existing knowledge on segregation of medical waste. It may assist primary health care managers to develop plans for improvement on gaps that may be identified and this might also help them to develop plans for in service training. The study may help the policy makers to plan and develop policies related to medical waste management and strengthen the proper values of medical waste disposal.

Reasons why the Participant may be Withdrawn from Study: Respondents will not be forced to participate because participation is voluntary and they will have full rights to withdraw

if they want to. Respondents who will be on leave during data collection will be allowed to withdraw if it affects their leave days.

Remuneration: There will be no monetary or remuneration that respondents will receive.

Costs of the Study: Participants will not pay to participate in this study.

Confidentiality: Participants will be informed that information obtained during the research will not be disclosed to unauthorised persons and will be kept in a safe place where only the researcher will have access. No information, including names and address of the participants, will be published because each participant will be presented as a number or code name to avoid disclosure of identity.

Research Related Injury: No research related injury is anticipated.

Persons to contact in the event of any problems and queries:

Please contact my supervisor Dr T.R. Luhalima on 072 482 3404 and co-supervisor Mrs Tshivhase S.E on 076 324 5376. The researcher's (Marubini Mufhumudzi) cell phone no. is 082 886 0464. You can contact 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

APPENDIX B: CONSENT FORM

CONSENT FORM

Statement of agreement to participate in the study:

I hereby confirm that I have been informed by the researcher (Marubini M), about the nature, conduct, benefits and risks of this study.

Research Ethics Clearance Number: **SHS/19/PH/26/2410**

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

I am aware that the results of the study, including personal details regarding my sex, age and date of birth 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 from the study

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

Full name of participant Date

…….. ……

I, Marubini M, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Full Name of Researcher: MARUBINI M

Date ……

Signature ……..

Full name of Witness (if applicable)

Date ……..

Signature…….

APPENDIX C: QUESTIONNAIRE

QUESTIONNAIRE

The main objectives of this study are to assess knowledge, describe practices and to determine the relationship between knowledge and practices of nurses regarding medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo Province.

Date of data collection: _____

Please answer the following questions by putting a cross (x) on the appropriate box.

Section A - Demographical Information

The information in this section will be used to compare knowledge and practices of nurses regarding medical waste segregation. (Indicate by putting a cross (X) where appropriate).

1. Gender

Male [ ] Female [ ]

2. Age

21-25yrs [ ] 26-30yrs [ ] 31-35yrs [ ] >35yrs [ ]

3. Professional Category

Professional Nurse [ ] Staff Nurse [ ] Assistant Nurse [ ]

4. Years of work experience

0-5yrs [ ] 6-10yrs [ ] 11-15yrs [ ] 16-20yrs [ ] >20yrs [ ]

Section B – KNOWLDGE

This section of the questionnaire seeks to gather the views of the survey respondents on the knowledge possessed by nurses on the segregation of medical waste. Mark with an x in the relevant box to indicate your level of agreement with the given statement. Strongly disagree means you highly disagree with the statement while strongly agree means you agree with the statement in a strongest sense.

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5	Personal protective equipment is used routinely when handling medical waste.					
6	Placing medical waste in wrong bin is a high risk.					
7	I am aware that there are waste bins for disposal of wastes as regulated.					
8	I know of policy documents regarding adequate disposal procedures of human tissue remains.					
9	Throwing human tissue remains in domestic waste is an adequate disposal procedure.					
10	It is necessary to sort medical waste at point of generation.					
11	Used dressings, cotton and plasters are considered medical waste according to medical waste classification.					

12	Used cottons, webcols and gauzes are classified as medical waste.					
13	Improper waste disposal can lead to needle stick injuries.					
14	The colour code for disposal of human tissues, anatomical and any infectious waste is yellow as per guidelines for waste management.					
15	The colour code for microbiological waste is red as per guidelines for waste management.					
16	Any waste mixed with medical waste must be treated as medical waste.					
17	Improper waste disposal may lead to transmission of diseases.					

SECTION C– PRACTICES

This section of the questionnaire seeks to gather respondents' views on the practices of health care workers on disposal of medical waste. Mark with an x in the relevant box

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
18	I always use gloves when handling medical waste.					
19	I always observe colour coding used for segregating medical waste during waste disposal.					
20	I dispose of liquid waste in bags that prevent leakage.					
21	I dispose human tissue remains in separate bags that prevent leakage.					
22	I discard empty packets and bottles of medication in infectious waste bins.					
23	I discard used ampules in a vial container.					
24	I discard used glass pipette in a sharp container.					
25	Used needles must not be recapped.					
26	I discard used needles immediately after use.					
27	I discard used needles in a designated sharp container.					
28	I report needle stick injury to the Occupational Health Nurse whenever it occurs to me.					
29	Medical waste containers are replaced when they are ¾ full.					

30	Medical waste containers are replaced after 3 months though they are not ¾ full.					
31	Medical waste containers are labeled with a date of first use.					
32	Personal protective equipment is always available.					
33	Waste monitoring inspections are conducted on monthly basis.					
34	A temporary waste storage area is available in the clinics.					

Thank you for your cooperation in completing this questionnaire. Kindly return the questionnaire as specified in the cover letter.

APPENDIX D : APPROVAL LETTER FROM UHDC

UNIVERSITY OF VENDA

OFFICE OF THE DEPUTY VICE-CHANCELLOR: ACADEMIC

TO : MR/MS M. MARUBINI

SCHOOL OF HEALTH SCIENCES

FROM: PROF. J.E CRAFFORD

DEPUTY VICE-CHANCELLOR: ACADEMIC

DATE : 22 AUGUST 2019

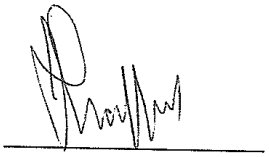
DECISIONS TAKEN BY UHDC OF 22nd AUGUST 2019

Application for approval of Mini-Dissertation Proposal Report in Health Sciences: **M. Marubini (11621354)**

Topic: "Practices of Nurses on medical Waste Segregation at selected Health Care Facilities in Sekhukhune District, Limpopo Province."

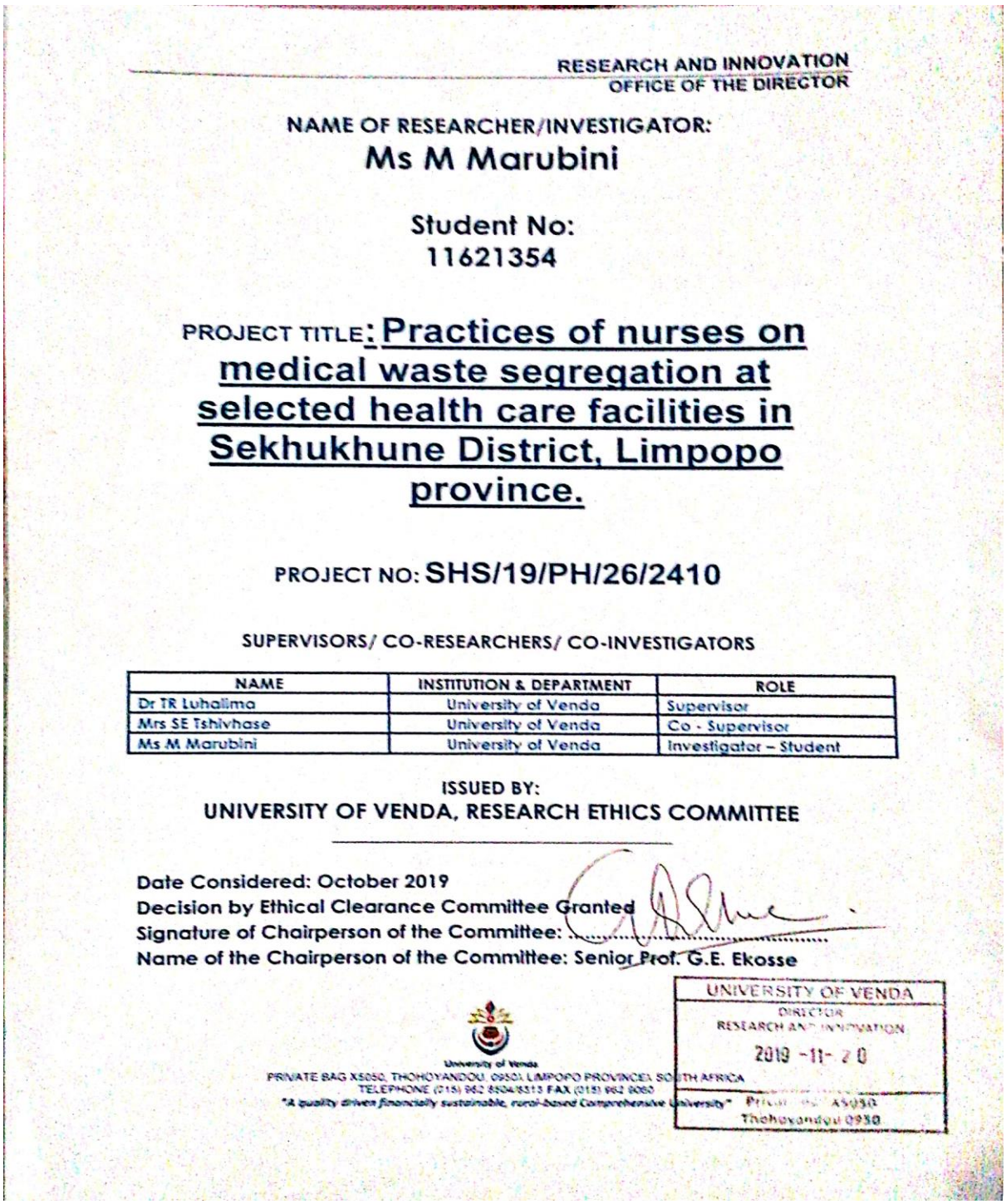
Supervisor	UNIVEN	Dr. T.R Luhalima
Co-supervisor	UNIVEN	Mrs. S.E Tshivhase

UHDC approved Mini-Dissertation proposal



PROF. J.E CRAFFORD
DEPUTY VICE-CHANCELLOR: ACADEMIC

APPENDIX E: ETHICAL CLEARENCE



RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Ms M Marubini

Student No:
11621354

PROJECT TITLE: **Practices of nurses on medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo province.**

PROJECT NO: **SHS/19/PH/26/2410**

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr TR Luhalima	University of Venda	Supervisor
Mrs SE Tshivhase	University of Venda	Co - Supervisor
Ms M Marubini	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: October 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
DIRECTOR
RESEARCH AND INNOVATION
2019 -11- 20

University of Venda
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"A quality driven financially sustainable, rural-based Comprehensive University"

Private Bag X5050
Thohoyandou 0950

APPENDIX F: APPROVAL LETTER FROM DEPARTMENT OF HEALTH

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Department of Health

Ref	:	LP – 2019-12- 003
Enquires	:	Ms PF Mahlokwane
Tel	:	015-293 6028
Email	:	Kurhula.Hlomane@dhsd.limpopo.gov.za

Ms M Marubini

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

Practices of nurses of medical waste segregation at selected health care facilities in Sekhukhune District, Limpopo province.

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 **Date** 10/02/2020

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

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APPENDIX G: APPROVAL LETTER FROM SEKHUKHUNE DISTRICT

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT

REF: S4/2/3

ENQ: KUPA MP

DATE: 26 FEBRUARY 2020

TEL:015 6332354

CEL: 079 411 6261

MATTER, PERMISSION TO CONDUCT A RESEARCH IN THE FACILITIES IN SEKHUKHUNE DISTRICT UNDER EPHRAIM MOGALE SUB-DISTRICT: MARUBINI M.

1. A permission is herewith granted to you pertaining to the above-mentioned study under Ephraim Mogale sub-district as approved by our Principals and copy attached thereto.

2. The District wishes you all the best and cooperation from the said institutions.

3. Your cooperation is greatly appreciated and hereby thanked in advance.

Ralefe

ACTING DISTRICT EXECUTIVE MANAGER

MRS RALEFE M.S

2020.02.26
DATE

APPENDIX H: EDITING AND PROOFREADING REPORT

Editing and Proofreading Report

08 February 2021

This letter serves to confirm that I, Dr I. Ndlovu of the English Department, University of Venda, have proofread and edited a dissertation titled "Practices of Nurses on Medical Waste Segregation at Selected Health Care Facilities in Sekhukhune District, Limpopo Province" by Mufhumudzi Marubini.

I carefully read through the dissertation, focusing on proofreading and editorial issues. The recommended suggestions are clearly highlighted and can either be accepted or rejected using the Microsoft Track Changes Function.

Yours Sincerely

Dr Isaac Ndlovu, PhD
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