AN INVESTIGATION OF THE HEALTHCARE WASTE (HCW) MANAGEMENT PRACTICES AT A PUBLIC AND PRIVATE HOSPITAL IN KHOMAS REGION, NAMIBIA

by

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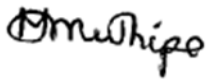
DECLARATION

I declare that **AN INVESTIGATION OF THE HEALTHCARE WASTE (HCW) MANAGEMENT PRACTICES AT A PUBLIC AND PRIVATE HOSPITAL IN KHOMAS REGION, NAMIBIA** is my own work and that all the sources that I have used or quoted have been indicated by means of complete references and that this work has not been submitted before for any other degree at any other institution.



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SIGNATURE **DATE**

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ABSTRACT

The purpose of this study was to investigate the HCW management practices at a public and private hospital in Khomas region, Namibia. A quantitative cross sectional descriptive design was used to compare the HCW management practices between the two hospitals. The study population included the nurses, doctors, pharmacists and cleaners. Purposive sampling was used to select the healthcare facilities and a stratified random sampling method was used to select the respondents from both hospitals. Three data sets were collected differently. Self- administered questionnaires were used to collect data from respondents while checklists were used during respondents' observation as well as during the inspection of hospital HCW records. Data collection was done in the whole month of June 2016 and observations of respondents were done for one whole week in each respective hospital. Hospital HCW records of the previous six months were reviewed. Data were captured on the MS Excel 2010 before analysis using the SPSS version 23.0.

The study results revealed that the respondents had good knowledge on the different types of HCW generated, the segregation of HCW, colour coding system, use of protective clothing, transportation and the impacts of HCW to human health and the environment. However the respondents did not possess enough knowledge on HCW management, particularly the HCW temporary storage area, weighing of waste, existence of a HCW policy, existence of a HCW management team and the availability of records of HCW generated in their hospitals.

Key words

Healthcare waste; healthcare waste management; knowledge.

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Dedication

I dedicate this dissertation to my two beautiful daughters Kudzaishe Rose Munukwa and Fadzaishe Chantelle Munukwa. One day you will grow old and be able to read and understand this dissertation.

I have set a good pace for you my children, the sky is the limit. Always remember that education is the key to a better life and in whatever you do, do not forget to give thanks to the Lord Almighty who makes everything possible.

God bless you.

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LIST OF ABBREVIATIONS

HCW	Healthcare waste
HIV	Human Immuno-Deficiency Virus
MET	Ministry of Environment and Tourism
MoHSS	Ministry of Health and Social Services
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
UNISA	University of South Africa
USA	United States of America
USEPA	United States Environment Protection Agency
WHO	World Health Organization

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

The issue of HCW management is very complex and broad and for it to be carried out with success, it must be understood by all levels of healthcare workers from the people washing the floors to the top senior managers or administrators (Cruz 2011:7). HCW management is a process which covers a lot of aspects such as planning, budgeting, staff training, proper transportation and disposal of HCW within the healthcare facilities and outside the facilities. It ensures the safe guarding of the public and environment from the risks associated with HCW. Any facility regardless of its size, which generates waste, should ensure that it acquires proper infrastructures and materials to deal with the waste it generates (MoHSS 2011b:22).

HCW management is a process which involves challenging issues such as the segregation, collection, the timeously removal and disposal of HCW. It also encompasses issues like illegal scavenging, occupational, environmental safety and the safety of the patient (Joshi, Diwan, Tamhankar, Joshi, Shah, Sharma, Pathak, Macaden & Lundborg 2015:2; Castro, Guimaraes, Lima, Lopes & Chaves 2014:861; Mohankumar & Kottaiveevan 2011:1625). It is argued that the inadequate management of HCW can result in associated risks to healthcare workers, leading to diseases like tuberculosis, pneumonia, diarrhoea, and tetanus amongst others (Indupalli, Motakpalli, Giri & Bengiri 2015:562).

HCW management remains an indispensable issue confronting many countries in the world, especially transitional economies. Namibia is one such country that has developed a National Waste Policy Management, with particular emphasis on HCW management in all healthcare facilities in the country (Ministry of Health and Social Services (MoHSS) 2010:2) According to the MoHSS (2010:5), the management of HCW in Namibia remains a major challenge since the waste generated from health facilities is not properly segregated. This is despite the fact that it is disposed in colour coded plastic bags, placed

in bins or receptacles located inside the facilities before being placed into the temporary storage area waiting for transportation to the incineration treatment facility. HCW management in Namibia is further complicated by multiple problems that include amongst others, an absence of a proper waste management system, the inadequate knowledge of hazards associated with the disposal, a limited budget that fails to enhance efficient waste management and disposal, and the poor control of waste disposal. In Namibia there is also a challenge of inadequate financial resources which are allocated towards the waste management sector by the government. Healthcare workers shortages are also experienced and as a result there are a few people with adequate knowledge to handle waste as the rate of staff turnover is very high in different sectors. The lack of a proper monitoring system to regulate and record the amount of waste generated is also a challenge and this has resulted in inadequate information on waste management functions which might be useful for planning and budgeting purposes (MoHSS 2010:5).

According to Manyele and Lyasenga (2010:305), in Africa, the situation of poor HCW management is similar in South Africa, Kenya, Mozambique, Swaziland and Tanzania. This is because illegal dumping of HCW is a serious problem in most developing countries. Manyele and Lyasenga (2010:305) further state that almost all countries recognized poverty as a basic factor hindering the success of African efforts in the sound management of HCW.

Results of a study done in Tanzania by Manyele and Lyasenga (2010:304) showed that most healthcare facilities are struggling to achieve high standards of HCW management because of financial constraints and lack of skills. The study showed that the funding for handling biomedical waste in the studied region was very poor resulting in the dubious handling of waste and thus posing a health hazard to waste handlers. Furthermore, the same study showed that most of the facilities did not have proper disposal sites and about 70% of healthcare facilities burned waste in poorly designed incinerators and open pits. Others carried waste to the dumpsites with their hands whilst others used wheelbarrows to carry waste to the disposal sites. In the same study a survey was done on disposal sites and more than half of the sites were not fenced and they were very close to human settlements, hence posing a threat to the community affecting both man and beasts (Manyele & Lyasenga 2010:304).

Healthcare without Harm (2015:1) argues that HCW management is underfunded and poorly implemented globally. The hazardous properties of HCW pose a serious environmental and public health threat. Recent studies have shown that half of the world's population is at risk from illnesses posed by HCW and poor waste treatment practices which result in the violation of human rights. It is further argued that hospitals can protect the health of the public by reducing the volume and toxicity of the waste they produce (Healthcare without Harm 2015:1). Currently there is no international convention that covers HCW management, so categorisation systems vary from country to country (Healthcare without Harm 2015:1).

Furthermore, the improper disposal of healthcare such as dumping of waste and burning of waste poses a great risk to humans worldwide as it contaminates the natural environment and the manmade environment by polluting the air and ground water, thereby affecting the wellbeing and health of humans. Worldwide there is evidence of major health effects related to the improper disposal of HCW (Robert & Ananias 2013:588). In addition, healthcare personnel, HCW handlers and the community are at risk of being seriously injured or infected as a result of the incorrect and unsafe management of such waste. These management practices include transporting the HCW by hand and scavenging through the waste by the healthcare workers and the community. Pruss-Ustun, Emmanuel, Rushbrook, Zghondi, Stringer, Pieper, Townend, Wilburn and Chartier (2014:4) has concluded that establishing good practices for the proper handling and disposal of HCW is an important part of the healthcare delivery system.

According to the Brazilian legislation, any unit that generates HCW is responsible for managing that HCW and it must develop a plan to guide each stage of the HCW management process (Alves, ESouza, Tipple, Ruzende, Kcad, De Resende, Rodrigues & Pereira 2014:40). This means the segregation, identification, packaging, collection, internal and external transportation, external storage, treatment and disposal (Alves et al 2014:40).

A study done in India in the healthcare units (clinics) and hospitals of both public and private sectors of Mysore district indicated that the district produces large quantities of HCW and the HCW handling is left to the poorly educated and lowest category of workers who do not have training and guidance relating to HCW disposal and management (Madhu, Narenda,Kousar & Puttaiah 2013:418). Harhay, Halpern, Harhay and Olliaro

(2009:1) pointed out an incidence in one of the India healthcare facility where about 240 people contracted Hepatitis B after being injected using syringes acquired through the black market trade of unregulated HCW.

According to Abah and Ohimain (2011:99), a number of studies have indicated that the inappropriate handling and disposal of HCW poses health risks to health workers who may be directly exposed to waste. People who stay next to health facilities and dumping areas, particularly children and scavengers, may become exposed to infectious wastes that may predispose them to conditions such as hepatitis (Abah & Ohimain 2011:99).

1.2 BACKGROUND INFORMATION ABOUT THE RESEARCH PROBLEM

The study took place at a public state hospital and a private hospital which are situated in Khomas region, Namibia. The public hospital is one of the level three government hospitals in Namibia and caters for the entire population of Namibia before referring other cases to the Windhoek State Hospital in the Khomas region. HCW generated in the surrounding hospitals and clinics are all sent to the public hospital incinerator. Whilst the private hospital sampled for this study is one of the four private hospitals in Khomas region.

Namibia is situated in the south-western Atlantic coast of the African continent and it borders Angola, Botswana, South Africa and Zambia. There are 14 Regional Directorates in Namibia which are demarcated according to the political regions of the country. The capital city of Namibia, Windhoek, falls under the Directorate Khomas region with a square kilometre area of 37590. The Khomas region is bordered by the Omaheke region in the east, Erongo region in the west, Otjozondjupa region in the north and Hardap region in the south.

According to the MoHSS (2011b:13), incineration is one of the current practices used in Namibia for HCW disposals and if not managed properly it can cause the release of harmful substances which result in air pollution and thus pose some risks to humans and the environment. According to other studies done (Ghasemi and Yusuff 2016:22; Mohankumar and Kottaiveevan 2011:1625) many incinerators are not of acceptable standard and lack skilled staff and proper maintenance. A review of secondary data indicated that the management procedures of HCW at ward level in Namibia had

improved but there were still key challenging issues in the storage and collection of waste. HCW is still mixed and the carts used to carry waste are worn out and as a result bags get damaged from the exposed metals of the transporting carts thereby exposing the waste bags (MoHSS 2011b:13).

An article in the *Windhoek Express Newspaper* showed that, smoke from the incinerator at public hospital produces a black cloud of smoke on a daily basis from the incinerator that covers the buildings in close proximity, which include the nurses' home at the public hospital. The smoke was allegedly reported to have a nasty smell and emitting harmful substances like dioxin and hence being a serious threat to the public (*Windhoek Express Newspaper* 2015:1).

1.3 RESEARCH PROBLEM

Namibia like any other developing country is characterised by a rapid growth in its population and a constant demand for improved services. Waste generation and improper management has become a global problem not only for the environment but also for the public at large. Healthcare workers at both the public and private hospital are concerned about HCW management in the two hospitals, particularly the possible negative effects to their health.

In Namibia healthcare workers shortages are also experienced; as a result there are a few people with adequate knowledge to handle waste as the staff turnover rate is very high in different sectors. A lack of a proper monitoring system to regulate and record the amount of waste generated is also a challenge and this has resulted in inadequate information on waste management functions which are useful for planning and budgeting purposes (MoHSS 2010:5).

HCW and its management is also of particular concern to the City of Windhoek and to the Namibian nation as a whole because of the risk it poses to humans and the environment. A previous study and assessments carried out by the City of Windhoek at various healthcare facilities in Windhoek revealed the following challenges which are related to the healthcare management practices in Namibia:

- There were no proper records kept of the amounts of HCW generated.

- Segregation of waste was being done in varying degrees, which indicates lack of uniformity in facilities.
- There was a lack of a uniform classification and colour coding system to enable effective segregation − as a result the amount of HCW requiring treatment is often high because of the mixture with other waste which is not necessarily hazardous.
- Waste was stored on site while awaiting collection and often the storage areas were not properly labelled and secured.
- Waste tracking systems were not in place in many facilities and records of the transportation of waste were not in place or the records did not have adequately comprehensive information.
- There were no particular standards for vehicles used to transport waste.
- There were unacceptably high emissions of pollutants from the treatment facilities (MoHSS 2011a:1).

The study showed the inevitable need for a holistic approach to HCW management in the country. The problems associated with HCW management are numerous and complex and require further investigation. It was therefore essential in the current study to investigate the risks associated with HCW generation and disposal. Thus it was important to look into the current practices of HCW management in order to establish what causes this lack of proper segregation of waste. The multiple complex problems that are associated with HCW management at public and private hospitals motivated a research of this kind.

1.4 PURPOSE OF THE STUDY AND OBJECTIVES

Joubert and Ehrlich (2007:60, 63) define the research purpose as a precise statement which expresses the main subject being described or the hypothesis being tested and the specific objectives as the specific information the study will yield, which are linked to the purpose or aim. The purpose of this study was to investigate the HCW management practices at a public and private hospital in Khomas region, Namibia and consequently, to be able to develop recommendations related to HCW management in the country.

1.4.1 Research objectives

The objectives of the current study were to:

- Determine the level of knowledge and awareness of healthcare workers regarding HCW management at the selected public and private hospital.
- Assess and compare HCW management practices at the selected public hospital and private hospital.
- Determine the extent to which the selected healthcare facilities, public and private hospital are complying with the HCW policy of Namibia.

1.5 SIGNIFICANCE OF THE STUDY

As a healthcare worker one should be concerned with avoiding the production of waste rather than its disposal, meaning that if the source of waste is minimized or controlled the impact on hospitals and other healthcare facilities will decrease. This study therefore seeks to improve on the methods of HCW management in Namibia, which might benefit both the public and health facilities. Thus, the implementation of the outcomes of the study is aimed at raising awareness to healthcare workers, the community and the government and other stakeholders on the effects of the improper care of HCW. If HCW is handled properly there will be a reduction in communicable diseases amongst healthcare workers and the community as a whole, thereby reducing government bills on acquiring medicines.

Proper HCW segregation ensures reduced quantities of HCW and some clean HCW will be recycled, hence reducing the amount of environmental and air pollution, both of which are a health risk to the nation as a whole. The study findings might ensure continuous training on HCW handling which will help raise awareness on HCW management and reduce incidences of sharp injuries in the hospital.

The study findings might also help stakeholders and health institutions in Namibia in putting in place or revising current policies on HCW care management in hospitals and the need for regular audits to assess how healthcare is handled. The significance of the study was to address a problem of HCW management which currently seems not to be effective at the two identified hospitals.

1.6 DEFINITION OF TERMS

Healthcare waste (HCW): is a by-product of healthcare that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials. It refers to a total waste stream from a healthcare facility (Pruss-Ustun et al (2014:3).

In this study HCW refers to all the waste produced at the hospital regardless of the type of waste.

Healthcare waste (HCW) management: includes all activities involved in waste generation, segregation, transportation, storage, treatment and the final disposal of all types of waste generated in the healthcare facilities which require special attention (Manyele & Lyasenga 2010:305).

In this study HCW management refers to the way in which HCW is taken care of from its source of production up to the final point of disposal, which can either be at the treatment facility or the landfill. It involves the HCW generation, handling, segregation, storage, transportation, treatment and disposal.

Knowledge: It has been defined as the means facts, information and skills acquired through experience or education. It is the theoretical or practical understanding of a subject. It is also referred to as the total of what is known (*Oxford English Dictionary* 2005:504).

In this study knowledge means information about the HCW, classification of HCW, generation process, segregation process, collection process, transportation, incineration and the safe disposal of HCW.

1.7 RESEARCH METHODOLOGY

1.7.1 Research design

A research design is the overall plan for obtaining answers to the research questions and in designing the study, researchers select a certain design and identify ways of minimising bias. Research designs indicate how often the data is collected, the types of comparisons to be made and the study location. It is referred to as the backbone of the study (Polit & Beck 2012:58).

A quantitative approach using a descriptive cross sectional survey research design was used in this study. Quantitative research is the investigation of phenomena that lend themselves to precise measurement and quantification, often involving a rigorous and controlled design (Polit & Beck 2012:739). In the research context, a survey refers to a data collection tool that consists of a series of questions designed to gather information about a relatively large group of people. A cross-sectional survey design is used to create an overall picture of a phenomenon at one point in time. Data is only collected once and there are no repeats (Du Plooy-Cilliers, Davis & Bezuidenhout 2014:149). In this study, data were collected using self-administered questionnaires, observation checklist and reviewing of hospital HCW records at the two identified public and private hospitals. Data were collected in the whole month of June 2016 in both hospitals. Questionnaires were administered through a pick and drop method. The researcher did observation rounds in the selected departments in both hospitals in order to validate the information obtained from the questionnaires. Hospital HCW records were also reviewed as part of data collection to check whether policies and HCW monitoring tools were available in the hospitals.

1.7.2 Population

Population refers to the full set of cases from which the sample is taken (Saunders, Lewis & Thornhill 2012:260). In this study the population included nurses, doctors, pharmacists and cleaners at the public and private hospitals who were on duty during the data collection phase.

1.7.3 Sample and sampling

A sample is a subset of a population comprising those selected to participate in the study. Sampling is the process of selecting a portion of the population to represent the entire population. A sampling frame is a list of all the elements in the population from which the sample will be drawn (Polit & Beck 2012:742).

Probability sampling involves a random selection of elements. Researchers can specify the probability that an element of the population will be included in the sample (Polit & Beck 2012:275). Probability sampling includes simple random sampling, systematic sampling, stratified sampling and multistage cluster sampling. In nonprobability sampling, non-random methods are used to select elements and every element does not usually have a chance to be included in the sample (Polit & Beck 2012:275).

The researcher used purposive sampling to select a sample of the healthcare facilities. Purposive sampling is a nonprobability sampling technique where the researcher chooses a sample with an intention to include a predetermined category of healthcare facilities of interest. It is also referred to as judgmental sampling whereby the researcher's knowledge about a particular population is used to select population members (Polit & Beck 2012:279). The researcher chose one public hospital and one private hospital for comparative purposes.

A stratified random sampling method was used to select a sample of respondents from the two hospitals. In stratified sampling, the population is divided into strata in order to enhance representativeness. Stratified samplings subdivide the population into uniform subsets from which an appropriate number of elements are selected at random (Polit & Beck 2012:281). The categories of each profession formed a strata and simple random sampling was performed to select a percentage of respondents for each strata. Stratification helped to ensure the representation of each category of healthcare workers and ancillary staff and also to improve estimators with less variation. A list of healthcare workers and ancillary staff were obtained from the two hospitals and numbers corresponding to the names were written on small papers and put in a container for each stratum and the sample was selected randomly. A randomly selected sample gives all the individuals in the sample an equal chance to be chosen. In a simple random sample,

individuals are chosen at random and not more than once in order to prevent a bias that would negatively affect the validity of the result of the experiment (Polit & Beck 2012:742).

1.7.4 Sample size

Sample size refers to the number of people who participate in a study (Polit & Beck 2012:742).

The overall sample size was approximated as in the formula below:

$$\boldsymbol{n} = \frac{\mathbf{z^2 p(1-p)}}{\mathbf{M^2}}$$

n = sample size for the infinite population

Z = Z value (e.g. 1.96 for 95% confidence interval)

p = population proportion expressed as decimal assumed to be 0.5 (50%)

M = Margin of error at 7% (0.07),

and strata sample sizes were approximated as $n_h = \left(\frac{\mathrm{N_h}}{\mathrm{N}}\right)\mathrm{n}$

n_h is the sample size for the stratum

N_h population size for stratum h

N is the population size

N is the total sample

The sample frame included all the nurses, doctors, pharmacists, pharmacists' assistants and cleaners in the different selected departments of the two hospitals which were under study. The accessible population was the healthcare nurses, doctors, pharmacists and pharmacist assistants who were on duty.

Inclusion criteria

According to Polit and Beck (2012:353), inclusion criteria refers to characteristics which a subject or element should have in-order to be part of the target population. In this study, the inclusion criteria for the sampling frame were all the nurses, doctors, pharmacists and cleaners who were on duty on the day of the survey and were willing to participate. The departments included were medical ward, intensive care unit, theatre, emergency centre, surgical ward, paediatric ward and maternity ward.

Exclusion criteria

According to Polit and Beck (2012:353), exclusion criteria refer to the characteristics that can cause an element or person to be removed from the target population. In this study all nurses, doctors, pharmacists and cleaners who were on duty but not willing to participate were excluded from the study. Other healthcare workers like radiographers, dental nurses, physio-therapists and care workers were excluded as the researcher wanted to include only those categories of healthcare workers which could be found in the two hospitals for comparative purposes.

Research technique

After receiving ethical approval from the Research Ethics Committee of the Department of Health Studies at UNISA to conduct the research (see Annexure A), the researcher obtained approval from the Ministry of Health and Social Services (see Annexure B), from the Medical superintendent at public hospital (see Annexure C), the Hospital manager at private hospital (see Annexure D) and from the Manager at City of Windhoek Solid Waste Division (see Annexure E). Informed consent was obtained from respondents aged 18 and above (see Annexure F). Pre-testing of the questionnaire was done through the pilot study with a sample population of 30 respondents in order to validate the strength of the research instrument used in data collection (see Annexure G for questionnaire). In addition a Cronbach`s Alpha was performed in order to ascertain the validity and reliability of the research instrument at coefficient value of .70. The respondents that participated in the pilot study did not form part of the final sample of the study.

The pilot study results helped in shaping the final tool for data collection. Du Plooy-Cilliers et al (2014:15) argue that pilot studies are conducted to eliminate problems that the researcher may not have foreseen when the research instrument was designed. After the pilot study data were collected by means of self-reported questionnaires in the form of hard copies which were distributed to the two hospitals considered in the current study, site visits were conducted afterwards to carry out direct observations using an observation checklist sheet to assess how waste was handled in different departments of the hospital by different categories of healthcare workers and cleaners. Documents and records were used to gather secondary data regarding the framework of HCW management.

1.8 DATA ANALYSIS

Data capturing, coding, validation and analysis was done using Statistical Package for Social Sciences (SPSS) version 23.0 and Ms Excel 2010. Survey data analysis is a process that involves five steps: data validation, response partitioning, coding, standard analysis, ordinal and nominal data analysis. More details on data analysis will be discussed in chapter 3.

1.9 VALIDITY AND RELIABILITY

Validity analysis (testing) was done using Pearson's product moment correlations by correlating questionnaire items by total score. The correlations allowed the researchers to determine the level of internal consistency of one item's scores with the composite scores from all other items designed to measure the same construct. Reliability analysis was used to assess the degree of internal consistency of scores from a set of indicators (questionnaire items).

1.10 ETHICAL CONSIDERATIONS

Ethical considerations had to be addressed in this study. Ethical issues deal with beliefs regarding what is right or wrong, proper or improper, good or bad when conducting research. Research should therefore be conducted in such a way that the rights and welfare of the respondents are always protected (McMillan & Schumacher 2014:203). All ethical issues which were taken into account during the conduction of this study have been described in detail in Chapter 3 of this study.

1.11 SCOPE OF THE STUDY

Although the findings of this study are important, wide spread generalisation and application of the study findings might be limited because of the narrow scope of this study as it was only centered at two hospitals, a public and a private hospital. It was useful to compare most of the public and private sector and other lower levels of healthcare practices such as primary healthcare centres in order to generalize the findings of the HCW management settings in the country.

1.12 STRUCTURE OF THE DISSERTATION

This research study is presented in five chapters.

Chapter 1: Overview of the study
Chapter 2: Literature review
Chapter 3: Research design and methodology
Chapter 4: Analysis, presentation and description of research findings
Chapter 5: Conclusions and recommendations

1.13 CONCLUSION

The chapter focused on the discussion of the introduction to the study, background of the study and fundamentally the research problem. The research objectives of the current study were discussed in this chapter. A brief theoretical foundation of the study was also considered in Chapter 1. The chapter also covered a brief discussion of the research methodology, research design, and methods of data collection, data analysis and ethical considerations. The pilot study was discussed in this chapter. Brief methods of validation of the research instrument used in the collection of primary data were also discussed in this chapter. The chapter is important in that it provides the framework of the research. This chapter leads the reader to Chapter 2 of the research.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter discusses related literature to the study. Literature review involves the process of gathering information on published research and theories and presenting it in an organised manner (Brink, Van Der Walt & Van Rensburg 2012:71). According to Burns and Grove (2005:93), a literature review is an organised piece of written work which has been published on a certain topic by different scholars. It acquaints the researchers with current knowledge and up to date information on issues pertaining to the topic of interest. In quantitative research, the literature review is done to direct the whole planning and the carrying out of the study (Burns & Grove 2005:93). It is important to understand what other researchers did in the area of study in order to identify gaps that exist in the current study (Burns & Grove 2005:93).

This study was an attempt to investigate the current HCW management practices at a public and private hospital in the Khomas Region of Namibia. The studies pertaining to the HCW management practices in the healthcare facilities or healthcare institutions were considered and reviewed in this chapter and presented under the following subheadings:

- Nature of HCW
- HCW generation
- HCW management
- HCW management practices
- Training on HCW
- Legislation on HCW

2.2 NATURE OF HCW

A lot of researchers from various countries share the same definition on HCW and they refer to it as waste which is produced from the treatment, diagnosis and immunisation of both humans and animals. Furthermore the waste could be any liquid state or solid state

including its container and if this type of waste is not managed correctly, it can cause a great risk to the patient and staff (Akum 2014:28; Badar et al 2014:145; Pinto, Joshi, Velankar, Mankar, Bakshi & Nalgundwar 2014:91).

According to the World Health Organization (WHO) (2005:2), HCW is defined as the total amount of waste from the healthcare facility which includes two categories, potential infectious and non-infectious waste. Infectious waste includes all the materials which have been in contact with human blood such as bandages, swabs and other items soaked with blood. Non-infectious waste includes the materials which have not been in contact with the patient's blood such as papers, boxes and plastic packaging. If the two categories of HCW are not separated and get mixed, the whole waste volume becomes infectious. Akum (2014:27), Abor (2013:375), Badar, Saeed, Yasmeen, Hussain and Amja (2014:145) also classified HCW into two categories, that is risky and non-risk waste. If the risky waste is not handled properly, it can lead to the development of different types of diseases such as hepatitis, cancers and respiratory diseases. The people at risk of contracting infections include pregnant mothers and their foetuses, patients and their visitors, waste handlers and Healthcare workers.

The United States Environmental Protection Agency (USEPA) 2013 as cited in Sarsour, Ayoub, Lubbad, Omran and Shahrour (2014:166) refers to HCW as medical waste and it also defines it as all the waste materials which are produced by healthcare facilities which include Items like used needles, body parts, soiled linen and dressings.

Cruz (2011:12) refers to HCW as medical waste and further argues that it is a broad term used to refer to all the waste produced in all healthcare or diagnostic activities. Dursun (2015:541) defines HCW as any leftover matter which is unwanted and which can only be disposed of either in the atmosphere, a water source or landfill after treatment. In addition, Abor (2013:375) defines HCW as all types of waste which are produced by both major and minor sources of HCW such as clinics, pharmacies and hospitals. A bigger proportion of HCW constituting about 75-90% of the waste generated in healthcare facilities is not harmful and can be treated like other household waste, whereas the remaining 10-25% is regarded as harmful or hazardous and should be given special treatment (Akum 2014:27; Pruss-Ustun, Emmanuel, Rushbrook, Zghondi, Stringer, Pieper, Townend, Wilburn & Chartier 2013:9).

In the United Kingdom, HCW is referred to as clinical waste and it is defined under the Controlled Waste (England and Wales) Regulations 2012 as any type of waste coming from a healthcare activity which has the following characteristics:

- Harbours micro-organisms which are capable of causing diseases to humans and other living creatures.
- Has a biological active pharmaceutical agent and is either a sharp or a biological material or body fluids contaminated with a very dangerous substance (Akpieyi, Tudor & Dutra 2015:127).

Sources of HCW are divided into two, major and minor sources. The former refers to all types of hospitals for example teaching hospitals, University hospitals, referral hospitals and district hospitals. It also encompasses other healthcare facilities such as emergency medical care centre, pharmacies, maternity units, dialysis centres and nursing homes. Small care establishments' fall under minor sources and these include dental centres, physicians' rooms, funeral homes, home treatment and chiropractors (Pruss-Ustun et al 2013:9).

Ciplak and Barton (2012:577) indicate that the terms HCW, medical waste, biomedical waste and clinical waste mean one and the same thing and they are used interchangeably in different parts of the world. In this study the term healthcare waste(HCW) was used as it is the acceptable term used in Namibia. In Namibia, HCW is defined as any waste which is generated in any healthcare facility, and the healthcare risk waste is any waste that is harmful to public health and the environment (MoHSS 2011b:1)

2.3 HCW GENERATION

Healthcare facilities have a sole responsibility of taking care of the HCW they produce and they should take appropriate actions to ensure that the HCW is managed properly (Akum 2014:27). Badar et al (2014:145) also adds that according to the international policy for developing countries, those who generate waste should take full responsibility in the proper management, treatment and disposal of that waste. The Brazilian legislation also stipulates that all waste producers should develop appropriate measures to guide each step of the management process from segregation, identification, packaging, storage, transportation, treatment and disposal (Alves et al 2014:40).

India is estimated to produce about 0.33 million tonnes of HCW per year and its generation rate is about 0.5 to 2.0kg per bed per day. This generation rate is due to a rapid increase in the number of healthcare facilities thus more HCW is produced, posing a difficult time for the local government (Muduli & Barve 2012:63; Pinto et al 2014:91). In another study in India, it was argued that 3 million tonnes of HCW are produced per year in India and the amount of HCW generated is expected to rise to about 8% per year. It is a very big challenge to treat a volume of HCW like 420 561 kg of HCW per day according to the set Biomedical Waste rules since the treatment facilities are not sufficient. They are only 157 and there is a need for the development of new technologies to treat HCW. Of the 420 461 kg of HCW produced, only about half of it (24 0682) is treated and out of 84 809 hospitals only 48 183 are using the biomedical waste treatment facilities (Mohankumar & Kottaiveevan 2011:1625).

According to Pruss-Ustun et al (2014:14), HCW generation differs from every country and also within each country. This is due to the fact that generation rates depend on different factors such as the type of healthcare establishment and its area of specialty and the type of activities at the different facilities. The use of disposable items versus the non-disposable items, the HCW management methods employed at the healthcare facility and the total number of patients seen per day can also affect HCW generation rates. In a study conducted by Ghasemi and Yusuff (2016:22) in Malaysia, the quantities of HCW generated were reported to be very high due to the severe acute respiratory syndrome and avian flu outbreaks. The HCW growth rate is expected to escalate to about 33 000 thousand tonnes by the year 2020 and there is a great need for Malaysia to develop better systems for HCW management to cater for such a growth rate.

A study done in Malaysia revealed that the number of foreign patients visiting healthcare facilities was high every year thereby contributing to the high amounts of HCW generated in the healthcare facilities. The foreigners are believed to be Asian people who migrate from their country to seek better and affordable healthcare and hence end up putting an excessive demand on the healthcare facilities (Bakriishak, Manaf & Abdullah 2014:25).

Badar et al (2014:145) reported that Pakistan hospitals produce about 250000 tonnes per year, and that HCW was not being handled correctly by the staff thereby creating a health and environmental risk. Tesfahun, Kumie and Beyene (2016:75) indicated that as the

population continues to grow, the number of healthcare facilities and the use of disposable products are also expected to increase and as a result the HCW generation growth rate will also continue to grow remarkably. Sartaj and Arabgol (2014:99) share the same view on the effect of population growth on the HCW generation rates, and argue that as the population and standard of living of people changes, there is also a bigger change in the amount of HCW produced. The importance of managing HCW in developing countries was also highlighted. Pruss-Ustun et al (2013:45) reported that about 21 million hepatitis B infections, 260 thousand HIV infections and 2 million hepatitis C viruses were caused by contaminated needles in the year 2000.

In their study, Tesfahun et al (2016:75) argued that the development of a model for the generation rate of HCW was actually a major step towards achieving proper HCW management. The development of these models should look at the different types of hospitals as HCW generation varies among hospitals. The results of their study indicated that the waste generation rate varies with the hospital type and that the public referral hospitals generated more HCW followed by the public district hospitals and lastly the private general hospitals.

According to Bin and Hai (2014:2591), the use of modern technology resulted in huge amounts of HCW being generated in the healthcare facilities. Of this amount, roughly 80% of the generated waste is not harmful or hazardous and the remaining 10-25% is said to be hazardous and causes a serious threat to the public and environment. If a proportion of the hazardous and non-hazardous waste gets mixed together, the whole load of waste is regarded as hazardous waste and it becomes a health hazard (Aghapour, Nabizader, Nouri & Monavari 2013:579).

According to Badar et al (2014:145), developed countries have managed to somehow control and stabilize the amount of HCW produced to very low levels as compared to the situation in developing countries which is still characterised by rapid healthcare facilities and high HCW generation rates.In another study done in Ethiopia, the HCW generation rates ranged from 0,361 to 0.669kg per patient per day, and it was noted that public hospitals generated more HCW than private hospitals and that the more patients admitted the more the HCW produced (Debere, Gelaye, Alamdo & Trifa 2013:13).

In Lagos, Nigeria, the population and the number of healthcare facilities are reported to be rising and this has led to the generation of more HCW. The problems identified in the Lagos study were the improper storage, frequent dumping of HCW and lack of awareness amongst the waste handlers and the rest of the healthcare workers (Awodele, Adewoye & Oparah 2016:269).

According to Kuchibanda and Mayo (2015:1), the developing world has been struggling to cope with the vast amounts of HCW produced per year due to the HIV/AIDS pandemic which caused an increase in hospital admissions and as a result an increase in HCW production. The countries are now focusing more on fighting the pandemic whilst at the same time neglecting the area of HCW management.

In a survey carried out by the Ministry of Environment and Tourism (MET) in Namibia in the year 2000, the amount of domestic waste generated was estimated at 0.5 kg per capita whilst that of HCW was 0.6kg per capita and the waste generation quantities were expected to rise with 2.5 % every year. These amounts were attributed to growth in the population and industry sector (MoHSS 2011b:9; MoHSS 2010:3).

2.4 HCW MANAGEMENT

According to Pinto et al (2014:91), healthcare activities are there to protect, restore health and save lives but during the carrying out of these good activities, HCW is produced in big quantities which need to be handled and disposed of safely. Public concerns for HCW have been there since the early 1980s when large quantities of syringes and needles were found dumped on the beaches of the East Coast of Florida, United States of America (USA).

Indonesia is the fourth largest populated country in the world with a total population of around 218 million people. The country has resorted to building more healthcare facilities as a measure to cope with the ever increasing population. As a result there is also an increase in the HCW generation rate. The main worry within the healthcare facilities is the lack of regulations which govern the safe management of HCW (Saat, Dan, Ke, Dalam & Limbar 2013:74).

According to the Pruss-Ustun et al (2013:45), a country needs support from the government in order to function effectively in improving HCW management. The government should put in place a policy which can be followed by different healthcare facilities towards improving the healthcare system. In addition, the policy should identify the needs of the country and stipulate other international agreements and conventions which are there to guide and protect the public health and environment, and to ensure safe handling of hazardous waste. Once the policy is in place, other guidelines and directives can be formulated which will stipulate what is expected from the staff and various methods of achieving good HCW management practices (Pruss-Ustun et al 2013:41).

In addition, Pruss-Ustun et al (2013:42) stipulated the five principles which have been proven to be effective in ensuring a controlled management of HCW. Different countries including Namibia have adopted the following principles in the formulation of their policies, guidelines and legislation on the management of HCW. These are:

- The *polluter pays* principle which states that the producers of HCW remain accountable and liable for their HCW and they should ensure that it is handled and disposed of in a manner which does not put the public and environment at risk. They shall be responsible for any damage caused by the HCW from their facility.
- The *precautionary* principle implies that preventive measures should be adhered to in order to prevent damage to the public and environment. It emphasises more on health and safety protection.
- The *duty of care* principle states that any person who is responsible or involved in the HCW handling should do or perform his/her duties to the best of his/her ability and should either be trained or have the necessary requirements to perform the task. For example a licence to treat or HCW.
- The *proximity* principle emphasises the use of the shortest possible available route to transport HCW. Hazardous waste should be treated and disposed of at the closest location to minimize risks which come with the waste transportation.
- The *prior informed consent principle* requires that the communities be informed of the risks which HCW can cause to the public and environment, and their consent should be sought whenever site and operational plans for HCW disposal are being made Pruss-Ustun et al (2013:42).

Sarsour et al (2014:164) did a study which looked into the medical waste management, its segregation, storage and disposal in public and private hospitals in the Gaza strip in Palestine and the study reviewed that a very low percentage of respondents had received training on HCW management. The study also argued that the ministry and the healthcare institutions are supposed to give more attention to the management of HCW through training of HCW management. They further reported that both the public and private sector still handled HCW inappropriately as indicated by respondents who reported the mixing of general waste and hazardous waste.

HCW which is properly managed should not cause harm to the public health and environment, especially with the availability of technological variations which can disinfect, neutralize or contain the HCW. Some of the good hospitals end up displaying bad healthcare management systems that are acting in unacceptable, unprofessional and corrupt ways because of lack of enough resources and proper infrastructure to handle HCW (Stringer 2011:4-5). In a study conducted by Stringer (2011:4), it was noted that there were inadequate resources for HCW management in low to middle income countries which was more in the public sector as the government is reported to be more likely prone to corrupt ways. The situation was said to be better in private owned facilities as they possess better resources for HCW management.

Stringer (2011:4) cited Manyele and Lyasenga 2010:305 who carried out a survey in two hospitals in Dar es Salaam, Tanzania and found out that more than half of the facilities which were studied did not follow proper HCW management practices; others disposed waste in open pits while others used malfunctioning incinerators to burn waste. The surveyed facilities were not adhering to the stipulated HCW management practices and similar situations were also reported in other African countries like South Africa, Swaziland, Mozambique and Kenya (Stringer 2011:4-5).

The aspect of onsite and offsite transport is of paramount importance as other studies reported that HCW was still being collected manually and disposed of together with the non-risk waste, therefore posing a great risk to the public and environment (Debere et al 2013:13). Abah and Ohimain (2011:99) reported that in Nigeria the HCW management practices were not appropriate and not safe for both the environment and the public.

Tesfahun et al (2016:75) cited some authors, (Altin et al 2003; Karamouz et al 2007; Taghipour & Mosaferi 2009) who argued that the most important step for good management of HCW is to have the exact information on the amount and composition of HCW generated. They further added that the HCW should be defined by its source of origin, the amount generated and waste type (Tesfahun et al 2016:75)

HCW poses a great risk to waste handlers, the patients, community and Healthcare workers. Healthcare services produce waste which has to be managed and disposed of in a proper and safe way in order to prevent risks which HCW pose to the staff, patients, the community and environment (Akum 2014:27).

A study done by Akum (2014:27) revealed that the area of HCW management was not being given enough attention in Ghana and this is supported by the results which showed that there is very little knowledge about HCW amongst the waste handlers. The study found that the healthcare workers did not separate waste; there were no financial resources allocated towards HCW management and that there were no HCW management guidelines or instructions in the hospital.

The Namibian country adopted WHO guidelines in their policies and guidelines as a tool for managing the HCW (MoHSS 2011b:22). According to the MoHSS (2011b:4), the aims or goals of the HCW management are to protect the patients, medical staff, public and the environment from the health hazards which can be caused by healthcare risk waste. The following waste hierarchy model is recommended for use in conjunction with the goals set in the planning of safe HCW management in Namibia. Figure 2.1 below depicts the waste hierarchy model.

Figure 2.1: The waste hierarchy

(MoHSS 2011b:4)

The MoHSS (2011b:6) contains information which helps the healthcare facilities to establish good healthcare management practices which are in line with the laws of the country. However, it has been noted that certain aspects of care and behaviour need to be changed in order for the facilities to offer the best management. According to the MoHSS (2011b:6), the bad practices which were noted include:

- Healthcare workers who do not have any idea about the risks inherent with HCW.
- Lack of awareness on the risks posed by HCW by people responsible for making decisions. Leaders or managers who put a low priority on issues related to HCW management and end up allocating inadequate resources for the HCW management.
- Healthcare workers who do not know and do no attempt to find out what really happens to the HCW produced in their healthcare facilities and remain ignorant about that subject area.
- Some healthcare facilities which do not have any plan for HCW management and also which do not train their healthcare workers on good HCW management practices.

2.5 HCW MANAGEMENT PRACTICES

According to Asante, Yanful and Yaokumar (2014:110), in their study on HCW management; its impact, a case study of the Greater Accra region, a lot of activities were done by the different healthcare facilities in the studied region of Ghana. They observed a lack of national policies, standard guidelines and operating procedures. HCW was not being segregated and labelled and there was no system of colour coding in place. The use of inappropriate substandard containers was noted as well as shortages in vehicles for transporting HCW. The storage sites were not lockable and they were not being properly managed and they had become breeding sites for animals, insect vectors and rodents. HCW was disposed of by means of either open burning, burying or dumping in the open ground.

2.5.1 Segregation

Castrol et al (2014:861) define segregation as the separation of HCW and this should start at the point or right source of HCW and waste should be separated according to its physical properties and the risk it poses. Bakriishak et al (2014:26), define segregation as the most crucial step in the management of HCW. It should be commenced at the point of HCW generation and if done correctly it can contribute to the effective management of HCW. However if segregation is not done correctly, it can pose a risk to the public and environment. Lack of segregation has become a challenging issue in many healthcare facilities and it needs urgent attention as most facilities end up disposing HCW anyhow. Joshi et al (2015:11) reported that segregation was not being followed correctly despite the rules set on how to carry it out. Some staff followed the segregation rules whilst others mixed the HCW and disposed it anyhow resulting in HCW being dumped anyway and colour coded bins not used.

According to Muluken, Haimanot and Mesafint (2013:316), the studies which were done in the developing countries revealed unsatisfactory results on the segregation, collection of HCW, storage and colour coding of containers. The facilities did not provide personal protective equipment and HCW was dumped in bins or open garbage along the roadside. In other surveyed healthcare facilities in Ethiopia it was reported that segregation was not practised and HCW was being stored, transported and disposed of inappropriately.

Indupalli et al (2015:563) reported that the healthcare facilities did not segregate the HCW properly and some of the healthcare is disposed in the local municipal bins which are located either in or outside the healthcare facility. The lack of proper human resources, lack of awareness on HCW and its hazards and the lack of sufficient funds are the most common problems faced in the management of HCW.

Kuchibanda and Mayo (2015:1) conducted a study in Shinyanga Municipality in Tanzania to investigate the management practices of HCW with an aim of assessing the health risks to the health workers and the general public. The results revealed that segregation was not being practised in all three hospitals which were under study. Onsite incineration and burning was practised. The healthcare workers did not have any formal training on HCW management and the hospital management paid little attention to the HCW management. In view of these results, it is evident that the management of HCW is not being practised according to the national policy or WHO set standards (Kuchibanda & Mayo 2015:1).

In another study in Iran, an analysis of HCW management was done in all public hospitals in Tehran (Malekahmadi, Yunesian, Yaghmaeian & Nadafi 2014:116). The results revealed that the area of segregation and disposal of HCW needed more attention and that there was a need to look into other alternative ways of HCW disposal. The aspect of HCW collection, storage and transportation was being carried out in a better way (Malekahmadi at al 2014:116).

According to Pullishery, Panchmal, Siddique and Abraham (2016:34), the health authorities in India are still facing a big challenge with the handling of bio-medical waste. The authors further stated that the cross-sectional study on awareness, knowledge and practices of health professionals in Mangalore, India, revealed that segregation of HCW was not carried out in most facilities and it was not satisfactory. Most of the facilities did not have proper HCW treatment and disposal facilities. It is the duty of all HCW generators to make sure that they handle HCW in a correct manner without putting the public and environment at risk. Out of the 157 respondents, the knowledge on the colour coding of containers was high amongst nurses (72.72%). Only 34 people were able to match the colour coding questions presented in the questionnaire. The results of that study revealed that proper segregation was only done in five hospitals in the urban area, while only 46% of the hospitals did the pre-treatment of waste. It was concluded that the level of

knowledge was very low because of poor training facilities and also the low educational level among cleaners and general workers who handle HCW.

Asante et al (2014:109) reported in their study in Ghana, that colour coding for bins and bags was not being followed by the healthcare centres which were studied. The healthcare policy manual of the Ghana health services stipulates the use of colour coded containers and bags to facilitate the segregation of healthcare; that is black bags for general waste, yellow bags for infectious waste and brown bags for hazardous waste. However in the majority of the studied facilities black bags were used to collect all sorts of HCW be it infectious or non-infectious HCW, making the collection of HCW inefficient. This posed a big challenge to HCW collectors who cannot differentiate the contents of the bags whether it is infectious or general. As a result all the bags get mixed up and they are treated as one type of HCW.

In Namibia, segregation is defined and carried out according to the stipulations in the Namibia Healthcare Risk Waste Management Directives (MoHSS 2011a:5). Segregation is defined as a process which ensures the separation of different types of HCW in order to manage different types of HCW appropriately. It ensures that different types of HCW get different types of treatment and disposal and this practice reduces management costs, the risks to the staff and also environmental harm. Colour coded containers are required to ensure the effective waste segregation of HCW (MoHSS 2011a:5).

Table 2.1: RECOMMENDED STEPS FOR THE MANAGEMENT OF HCW

Key Steps	Definition
Identification	Identification and classification on waste material
Segregation/ Containerization	Segregation at the source based on categories: • Sharps (medical needles and other surgical instruments) • Infected waste (biomedical, from surgery, nursery) • General waste (food scraps, paper, plastics Sorting the waste into color-coded plastic bags or containers
On-Site Storage	Separate storage facilities (temporary before waste is transported to treatment facility) Packaging and labeling
Transportation	Using specific containers and designated vehicles to transport waste to treatment facility
Off-site Storage	Storage at treatment facility

(Adapted from MoHSS 2011b:22)

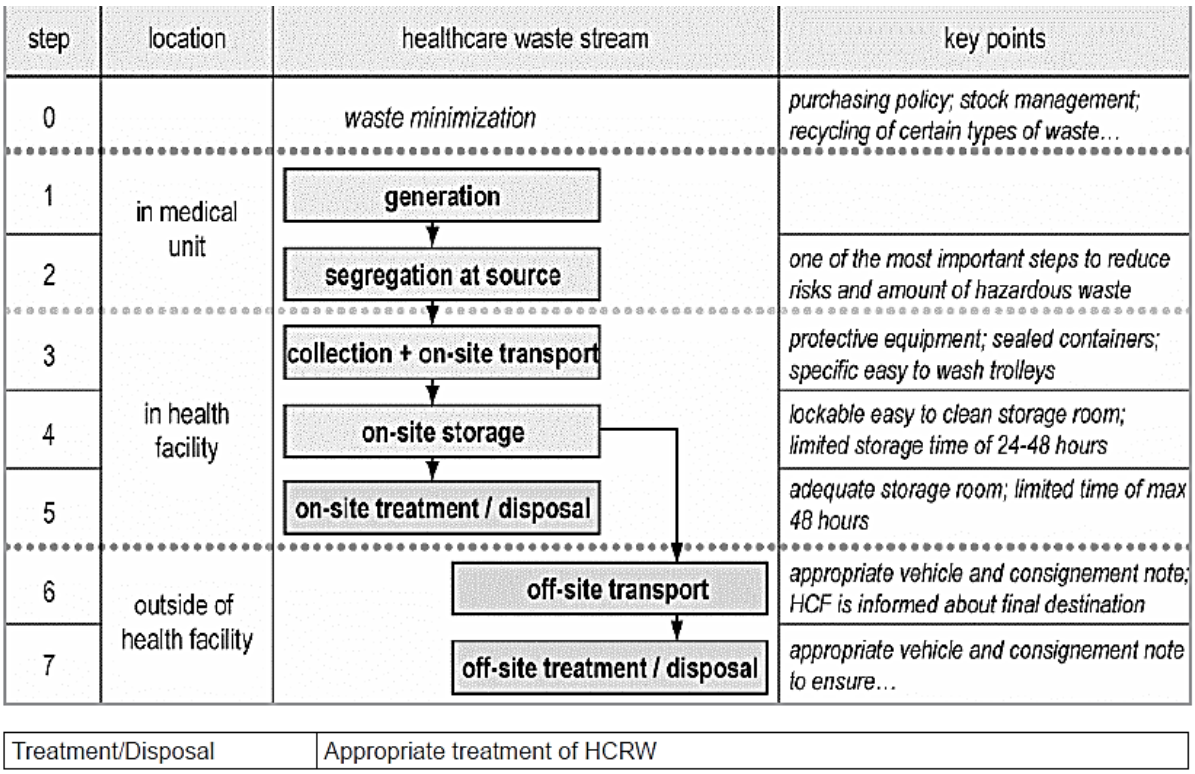


Figure 2.2: Key steps to the management of HCW

(Adapted from MoHSS 2011b:23)

In Namibia, HCW is classified according to the following categories and colour coding schemes:

1. Category A for non-risk HCW which include left over kitchen waste which is placed in yellow bags and the domestic waste which is placed in black bags.
2. Category B is the healthcare risk waste requiring special care include the following:
   a) B1 (human anatomical waste) which should be placed in red bags with a biohazard symbol affixed to the bag. The bags should be made of leak proof material and should be strong so that they do not tear easily during waste transportation.
   b) B2 (sharps) should be placed in yellow containers which are very strong, rigid and cannot be punctured easily. The containers should also have a biohazard symbol affixed to them and labelled as sharps.
   c) B3 (pharmaceutical waste) should be placed in brown containers which are strong and leak proof and should be marked danger and have a flammable sign affixed to them.
   d) B4 (cyto-toxic pharmaceutical waste) should be placed in a brown bag which is strong and leak proof and should be marked as cytotoxic waste.

e) B5 (blood and body fluids) should be placed in red, strong, leak proof bags or containers which have a biohazard symbol affixed to them.

3. Category C is the infectious and highly infectious waste.

a) C1 infectious waste should be placed in red bags which are leak proof and should be labelled highly infectious

b) C2 highly infectious waste should also be placed in the red bags which have leak proof material and should be labelled highly infectious.

4. Category D is for other hazardous waste and should be placed in yellow rigid plastic containers which are leak proof and strong. A biohazard symbol should be attached or affixed to the container.

5. Category E is for radioactive waste and should be placed in a double plastic bag, no colour is specified but a radioactive symbol should be affixed to the bags. Alternatively a drum which can be sealed can also be used (MoHSS 2011a:6).

The following are the examples of different signs to be fixed on different types of bags or containers for HCW:

a) Universal biohazard sign

b) Radioactive symbol

c) Flammable sign

Different types of bags used for different types of waste:

a) Black refuse bag used for general waste

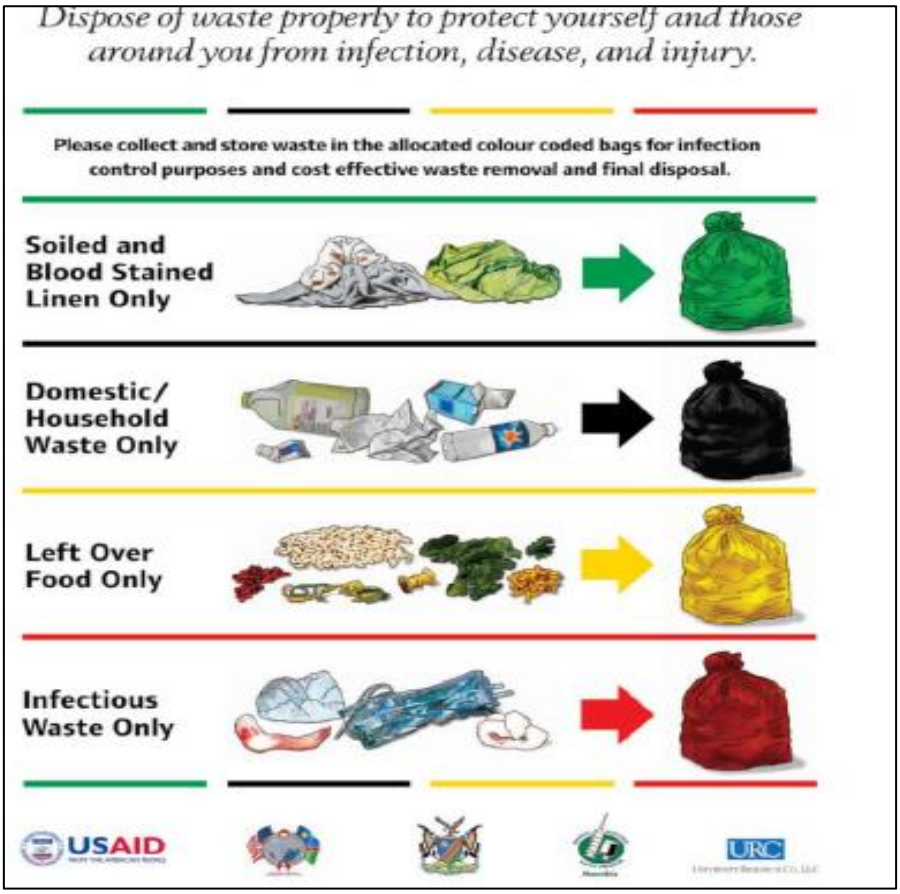
b) Yellow refuse bags used for food left overs

c) Red refuse bags used for infectious waste

d) Buckets used for cytotoxic waste

e) Boxes used as sharps containers for sharps waste

(MoHSS 2011b:24)



United States Agency International Development (USAID) poster for HCW segregation

(Adapted from the MoHSS 2011b:93).

2.5.2 Storage

According to the MoHSS (2011a:11), all healthcare facilities should have a temporary cold storage area for storing HCW before the HCW is treated or sent for treatment and disposal. The onsite storage area should have the following:

- The floors should be easy to clean, have concave round edges, and have a free and good drainage system and should be impermeable as well.
- No unauthorised entry should be allowed. The place should be kept locked at all times to ensure a controlled movement.
- There should be free air circulation and adequate lightning.
- The storage area should be easily accessible to staff who are in charge of handling waste.
- Easily accessible to waste vehicles.

- It should be free from adverse weather effects like rain, strong winds and the sun.
- The storage area should be marked with a biohazard sign and entry should be restricted.
- Availability of a water source for cleaning purposes.
- The storage area should have a scale to measure waste (MoHSS 2011a:11).

Pruss-Ustun et al (2014:65) indicated the same storage requirements as above but added that the storage areas should be situated far away from the place where food is kept or food preparations are made and that there should be the availability of cleaning equipment, protective clothing, and waste bags close to the storage area in case of spills.

Table 2.2: TIME FRAMES FOR STORAGE OF HCW RECOMMENDED BY THE MoHSS

Type of waste	**Classification**	**Time limit (no cold storage)**	**Time limit (cold storage)**
Pathological waste Blood and body fluids	B1 B5	24 hours	72 hours
Infectious waste	C	24 hours	24 hours
Sharps	B2	30 days	30 days
Pharmaceutical waste	B3 B4	90 days	90 days
Chemical waste	D	90 days	90 days

(Adapted from MoHSS 2011a:11)

The above time frames for the storage of HCW (table 2.2) should be adhered to at all times by the healthcare facilities. According to the MoHSS (2011a:11), all healthcare facilities should keep a register at their storage facility in order for them to control the incoming and outgoing waste. The waste register should include the source of waste generator, for example operating room or medical ward, the type of HCW, the amount of HCW and the date the HCW was brought to the storage area. All types of HCW, sharps excluded, should be stored in rigid containers whilst it awaits transportation to the treatment or disposal site. The containers should be of the same colour code as the HCW bags.

According to MoHSS (2011b:16) in Namibia, the following key challenges in the storage and collection of HCW were observed at ward level:

- There is no limit to the quantity of HCW to be placed in one bag. The healthcare workers fills up the bags anyhow.
- Different types of receptacles are being used for the placement of HCW despite the stipulated pop up lid containers which limit the contact with infectious waste.
- Bags are not labelled to indicate the date, where they are originating from and the type of contents. Some of the bags are not sealed properly and they can be more than three quarters full.
- HCW segregation is not being followed accurately.
- Some HCW is transported in worn out metal carts which can damage or tear the bags during the transportation of HCW and cause HCW spillage which poses a great risk to the person transporting the waste.
- The storage facilities at the state hospitals were found to be poorly managed, some were overcrowded, and some did not have guidelines for managing spills (MoHSS 2011b:16).

According to a study by Muluken et al (2013:319), most of the surveyed healthcare facilities had no temporal storage facilities and HCW was taken to the back yard within 12 hours of HCW generation. The placentas from the maternity unit were taken to the placenta pits for burial.

2.5.3 Transportation

The proper collection and transportation of HCW is an integral part of the HCW management practice and it requires the involvement of a multidisciplinary team for it to function smoothly and efficiently. For example the health personnel's cooperation is required as well as that from the technical department, housekeeping and fleet services (MoHSS 2011a:11). The onsite transportation of HCW should be carried out using wheeled trollies (MoHSS 2011b:30).

According to a study conducted in Namibia, the following were observed:

- HCW was not being weighed; as a result there were no accurate data on the HCW generated at different healthcare facilities.
- The consignment note was not being utilised correctly by the transporters; as a result it was difficult for facilities to track the HCW (MoHSS 2011b:15).

According to MoHSS (2011a:12); MoHSS (2011b:31) the following are the recommendations or requirements for vehicles used for transporting HCW:

- The vehicle should only be used for carrying HCW not for any other functions.
- The vehicle should have a suitable body size and a height of about 2,2 metres.
- The vehicle should have rounded edges to facilitate easy cleaning and its finishing should be compatible with steam cleaning.
- The HCW should only be transported by a waste contractor who is registered and possesses a license from the municipality.
- The vehicle should have accessories to secure the load in place.
- The vehicle should be lockable.
- The vehicle should have a leak proof body and should also have a separate compartment to store emergency equipment like a spill kit.
- The name and address of the contractor (contact details) should be displayed on the vehicle.
- The international biohazard sign should be displayed on the body of the vehicle.
- The driver of the vehicle should be trained on how to handle the type of HCW to be transported.
- All vehicles should carry a consignment document from the point of HCW collection to the treatment and disposal.
- The vehicle should display the approved license disc for carrying HCW (MoHSS 2011a:12; MoHSS 2011b:31).

Pruss-Ustun et al (2014:75-76) added that the vehicle should also have a protection part like a bulk head between the driver's cabin and the vehicle's body in order to retain the HCW load in case of vehicles colliding. The vehicle should also be kept locked except during loading and offloading of the HCW. The producer of HCW and the HCW transporter should agree on the shortest possible route for transporting HCW and further

handling of HCW after it has left the production point is prohibited except in cases of accidental spillages.

The MoHSS (2011b:31) further stipulated how the consignment note should be handled by the transporter of HCW. The consignment note is known as a Manifest Document in Namibia. The following should be adhered to:

- The transporting company is supposed to issue the HCW producer with a copy of the consignment note for record keeping.
- The HCW transporter and the HCW producer will both have a separate copy of the consignment note.
- The consignment note should have all the details of the HCW producer even if the HCW producer is transporting its HCW.
- All HCW producers should meet the indicated requirements from the transporting company.
- The transporting company should always have the consignment note readily available in the vehicle while transporting HCW and this document should be made readily available on demand by any authorities doing spot checks.
- The transporter shall furnish the facility receiving the HCW with the original copy of the consignment note (MoHSS 2011b:31).

2.5.4 Treatment

HCW is treated in order to change its physical or biological or chemical properties so as to reduce its potential for transmitting infections. The following characteristics should be put in mind when choosing a treatment method:

- The treatment method should be able to cater for vast amounts of HCW.
- The method should be able to limit or control the spread of pollution.
- The method should not be a threat to underground water sources.
- The method should be cost effective such that it will utilise less chemicals which are safe for the environment (MoHSS 2011a:14).

According to the MoHSS (2011b:15), incineration is the treatment of choice in Namibia. It is used for HCW disposal. If the incinerators are not well managed they can emit harmful substances which may cause serious air pollution which can affect the health of the surrounding people and their environment. A study done at ward level in Namibia revealed that most of the incinerators being used are of a low standard and healthcare workers that lacks proper training and skills are operating them. The following key challenges were observed:

- The incinerators are not operating within the optimum temperatures of above 800 degrees Celsius. Healthcare risk waste is supposed to be blended instead of being batch fed. The blending of HCW is a challenge since bags are not labelled with the contents they possess.
- Every incinerator has specifications on the amount of HCW to be loaded per hour. There is a challenge as to how much HCW should be loaded as the HCW is not weighed at the incinerator before it is loaded. For example at the public hospital incinerator, its loading capacity is 132.5kg per hour, so it is now uncertain how the loading of HCW is done.
- The incinerators do not have automatic feeding devices and this poses a risk to those who operate them as vials or ampoules can explode in the feeding process.
- Incinerator operators lack adequate training and use questionable personal protective equipment (MoHSS 2011b:15).

Other HCW management treatment methods practised in Namibia include the following:

- Burning is not an option which is advisable given its direct effects on the environment. If practised it should be done under close and strict supervision. The treatment method is mostly practised in rural areas, villages and small towns.
- Use of landfill sites is mainly done in Windhoek and at the coast in Walvis Bay.
- Dumping is mostly used for household refuse and garden refuse.
- Effluent disposal entails use of dams and septic tanks for disposing liquid waste, for example sewerage system.
- Hazardous chemical waste disposal (MoHSS 2011b:12).

Stringer (2011:6) reported that about one fifth of HCW workers in Bangladesh had received the most basic information about HCW management. Some received the information from outside sources other than their line managers or colleagues. A study similar to this current topic was carried out by Abor (2013:384) in two public hospitals and two private hospitals. The government hospitals generated more HCW than the private hospitals, and it was reported that three out of the four hospitals segregated HCW correctly. All the hospitals had internal storage facilities. At the government hospitals, HCW was transported using wheelbarrows whereas at the private hospitals they used wheeled trollies. The hospitals under study adhered to the safe disposal methods of HCW but some of the hospitals did not have any committees for managing HCW. Abor (2013:384) concluded by saying that the way the HCW is being handled in Ghana is not the best and improvements need to be done, especially by encouraging hospitals to form committees for managing HCW. Staff should also be well informed through policies and guidelines. The author recommended that private hospitals should consider looking into their segregation practices and adopt the use of colour coding bags.

According to Pruss-Ustun et al (2013:35), studies have reported the lack of information on the effects of exposure to HCW to the public and environment in the developing countries. Harhay et al (2009) as cited by Pruss-Ustun et al (2013:35) reported that there is an assumption that more than half of the global population is at risk of the public and health exposure effects from the poorly managed HCW. The huge amounts of HCW are due to the large volumes of HCW produced with lack of adequate resources to cater for the ever growing HCW rate.

Asante et al (2014:108) cited Healthcare without Harm (1999) who reported a lack of proper HCW management systems in most of the developing countries. Onsite incineration, autoclaving and steam disinfection were said to be some of the few frequently used treatment choices for very small amounts of hazardous waste. Incinerators in poorer under developed countries were reported to be operating under substandard conditions and they were malfunctioning or not operational.

Asante et al (2014:108) further state that the healthcare facilities in Ghana need to look into more options of acquiring better methods of HCW treatment for long term future use. Most of the healthcare facilities in Ghana are being operated on a tightly limited budget; as a result there is a lack of funds to access more efficient and sound environmentally

sustainable treatment. At present, the healthcare treatment methods are posing a serious environmental problem in cities and local communities, exposing the public to foul smell, air pollutants, contaminated sources of water and toxic ash from the surrounding healthcare facilities. The De Montfort medical incinerator is used to treat HCW in Ghana, and due to lack of treatment facilities, some HCW is disposed of without being treated, thereby posing a great risk to the Ghanaians (Asante et al 2014:108).

In their study in Ethiopia, Muluken et al (2013:319) reported that some healthcare facilities attempted to treat their HCW with either alcohol or barakina before disposal. Another facility used an autoclave to treat biohazard waste in their laboratories. In all the other surveyed hospitals, HCW was either treated by incineration or open burning. Open burning was used by all the facilities to treat dressing materials and only three out of the eleven facilities under study used incineration technology to treat sharp waste.

2.5.5 Disposal

In 2002, WHO conducted an assessment in 22 developing countries which revealed that about 18% to 64% of the healthcare facilities did not use the proper healthcare disposal methods (WHO 2005:3).

HCW dumping is done as a cheaper or easier option for hospital or waste disposal contractor companies and it usually happens not because the systems to cope with the HCW are not available but because they are avoided. It was reported that in low to middle income countries there is a problem of governments with corrupt systems. The resources for taking care of the HCW are usually inadequate or not available except in private healthcare facilities (Stringer 2011:9).

Bin and Hai (2014:2591) reported that a lot of healthcare facilities lacked an effective systems approach for the disposal of HCW as the HCW is disposed of in municipal waste in bins along the roadside and a certain fraction is reported to be buried without following any precautionary measures, for instance burning the HCW in an open environment.

According to Asante et al (2014:107), there is a dilemma in the disposal methods of HCW in Ghana. Some facilities bury their HCW, treat it with chemicals, some mix the infectious waste together with the domestic refuse and dump it in the open environment. These

unsafe disposal methods of HCW are not hygienic and at times HCW is seen scattered all over by scavengers. The other problem is the strong foul smell which arises from buried placentas and limbs especially after a rainfall. If HCW is not handled properly, serious diseases can result, pathogens from the infectious waste can enter through broken cuts, skin punctures, mucous membranes, swallowed or inhaled into the lungs.

According to Stringer (2011:10) a lot of incidences on HCW dumping were reported in South Africa, the highest being in the Free State where about 1700 tonnes of HCW was dumped at four different sites and costed about R53 million to clean up and also nine companies facing criminal charges. Furthermore, about 21 babies were discovered in a lake in China and some of the babies had identification tags on them and one of them was wrapped in a plastic which was labelled as medical waste (Stringer 2011:10). In another incidence, in Kolkata, some HCW which was meant to be disposed at a treatment facility ended up on an illegal pit where a group of women were given remuneration in order to separate the waste for syringes and other recyclables and the syringes were sold for US$0, 85 per kilogram (Stringer 2011:10).

According to Stringer (2011:9), India has the highest number of incidences as HCW dumping is a daily occurrence despite the country having clear biomedical rules since 1988. The current number of treatment facilities ranges from 157 to 170 and they are said to be insufficient. The 2010 review of the Central Pollution board reported that out of all the hospitals, only 57% were said to be making use of the treatment facilities or hired private agencies (Stringer 2011:9) Stringer (2011:9) further reported that only half of the country's HCW was treated and collected according to the set biomedical rules. Approximately 420,621 kg of HCW is produced on a daily basis and only about half of it (240,682 kg) is treated and the remainder which is roughly about 180 tonnes daily is either disposed of as municipal waste or dumped illegally or it penetrates the recycling market (Stringer 2011:9). Some of the pictures below are from Pondicherry a southern Indian state where garbage of all types is dumped by a truck and some of it is dumped in streams which are used as a source of drinking water by the surrounding communities. Some of the pictures are from sub-Saharan Africa (Stringer 2011:9).

Figure 2.3: Medical and municipal waste dumped at Pondicherry truck station (Brooks Anderson)

(Stringer 2011:10)

Figure 2.4: A cow searches for food amongst the red bags of HCW dumped near the truck station in Pondicherry, India (Brooks Anderson)

(Stringer 2011:10).

According to Stringer (2011:11) cases of HCW dumping are reported more often in places like the United States and Canada. In the past there were quite a number of reports of HCW found on the beaches of the United States and such incidents were also recently reported in 2009 in New Jersey and in 2011 in Hawaii (Stringer 2011:11). In another incidence British HCW was found mixed with the general waste that was exported to Brazil for recycling. In addition, a HCW disposal company in Saudi Arabia was fined an

amount of USD5300 for disposing its HCW at a municipal landfill and some were reported to be dumped near a drinking water source (Stringer 2011:11). In India, about 180 tonnes of HCW which is not sorted is dumped in the municipal garbage and this is said to be probably the main disposal route practiced by some low to middle income countries (Stringer 2011:11). HCW can also be found dumped in the backyards of hospitals, or at times in the vicinity in public areas or along the streets awaiting collection by the municipality (Stringer 2011:11).

Burning and incineration of all types of HCW can result in atmospheric emissions which can travel worldwide and hence interfere with the people's right to a safe and healthy environment (Stringer 2011:12).

Figure 2.5: Waste which was being burned at one of the hospitals in Nepal The site was later cleaned after the photo was taken by Nakarmi/HECAF
(Stringer 2011:13)

HCW disposal can be so poor in certain areas in such a way that it will end up affecting the whole community. There was a report from the Pune Mirror of India which wrote about dirty unpleasant conditions at the Aundh General hospital where HCW was seen all over the hospital grounds and animals like cows, pigs, goats and dogs were seen roaming around the site (Stringer 2011:20). The following images show how HCW is disposed of repeatedly by some healthcare facilities in various parts of the world (Stringer 2011:20).

Figure 2.6: Mixed types of waste awaiting the waste transporting company (Stringer/HCWH)

(Stringer 2011:22)

Figure 2.7: Staff member carrying waste by hand. (La Prensa, Honduras)

(Stringer 2011:22)

Figure 2.8: Scavenger in Kathmandu. (Nakarmi/HECAF)

(Stringer 2011:26)

Figure 2.9: HCW dumped at a city dump in Tanzania (Stringer/HCWH) (Stringer 2011:27)

Figure 2.10: Some elephants in Botswana looking for food at a dumpsite containing HCW

The elephants are said to be prone to human tuberculosis (courtesy J Emmanuel)

(Stringer 2011:32)

According to Stringer (2011:13), some incinerator ash is often dumped nearby or buried carelessly around premises. Burning cannot destroy items like sharps, so blades and needles can still be seen in the ash and they can still cause injury to the people who will come into contact with them. Some incinerator ash can be blown by the wind and cause local contamination and chickens can be seen scratching in the ash pits (figure 2.12). See pictures below:

Figure 2.11 Sharps waste after being incinerated
The sharps can still cause injury in that state as burning cannot destroy sharps. (Stringer/HCWH)
(Stringer 2011:15)

Figure 2.12: Some chickens seen scratching for food at a hospital incinerator ash pit in Tanzania (Stringer/HCWH)
(Stringer 2011:13)

Figure 2.13: A dog sniffing on some pathological waste on the streets of Kathmandu (Nakarmi/HECAF)

(Stringer 2011:11)

Figure 2.14: A human leg was discovered during a waste audit packed together with other waste for disposal through the municipal system (Nakarmi/HECAF)

(Stringer 2011:11)

Muluken et al (2013:319) in their study in Ethiopia reported that all healthcare facilities disposed of their HCW in an unsafe manner. The final disposal methods and locations did not match the WHO standards. Incinerator and open burning methods were commonly used methods and the incinerators were not performing well due to lack of regular maintenance. Some disposal sites for burying HCW were constructed too close to the

water bodies and residential areas, thus posing a great risk to the environment and the public.

2.5.5.1 Potential impacts of HCW

HCW can have a direct impact on both the public and the environment. Human health can be greatly affected through the use of contaminated water bodies and breathing polluted air. Air pollution can occur as a result of HCW being burned in the open or in incinerators which do not have any emission control. As a result pollutants like furans and dioxins get released into the atmosphere thereby contaminating the air and this can cause serious illness to those who will breathe the air. Water bodies can be contaminated when HCW is disposed in pits which are not lined and are also close to water bodies (WHO 2005:3).

If HCW is not well managed, it can result in serious diseases like genital deformities, infertility, hepatitis, Acquired Immune Deficiency Syndrome (AIDS), typhoid, cholera, neurological disorders in children and other viral infections (Badar et al 2014:146). Muduli and Barve (2012:65) further added that pollutants like mercury and dioxins have been detected in the air and they can also cause serious effects on the public health. Dumping of HCW anywhere can result in contaminated soils and underground water and the antibiotics which are poured down the drains in healthcare facilities can destroy most beneficial microbes and bacteria in the septic systems.

According to Mohankumar and Kottaiveevan (2011:1625), HCW causes environmental problems such as the spread of infections and diseases through vectors which affect both admitted patients and the whole population. Infection can be spread through direct contact with HCW, through the use of recyclable disposable items such as syringes and needles. Reactions can also occur through the use of expired and discarded unwanted medications. Human Immuno-Deficiency Virus (HIV), Hepatitis B, and Hepatitis C are the 3 three main common infections transmitted through exposure to HCW. It is reported worldwide that about 3 million people get exposed to the blood borne pathogens and of this figure, 2 million are said to be exposed to hepatitis B, 0,9 million to hepatitis C and about 170 000 to HIV (Mohankumar &Kottaiveevan 2011:1625).

Saat et al (2013:74) posit that Indonesia was reported to be facing a lot of environmental problems due to the mismanagement of HCW by the healthcare facilities. It is said that most facilities do not have any policy frameworks or guidelines for HCW management.

Ozder, Teker, Eker, Alt, Kocaakman and KarAbahy (2013:1) also profer that if HCW is not managed effectively it can result in or pose a health risk to patients, the environment and the healthcare facility employees. It is of paramount importance for the healthcare managers to be well knowledgeable and aware of HCW management practices as the collection and storage of the HCW in their facilities is one of their major responsibilities.

According to a study conducted in Bangladesh by Bin and Hai (2014:2591), environmental pollution was reported as an important public health concern and public awareness to HCW has since grown due to the expansion of healthcare services and the use of disposable products which result in the generation of more HCW. The emergence of AIDS was also seen as another factor which raised public awareness towards HCW. The Ministry of Health and Family Welfare intervened by involving itself in extensive training programs in HCW and by supplying coloured bins to the institutions. However the management of the HCW remains unsatisfactory in Bangladesh.

According to Stringer (2011:7), there is little published information or none at all pertaining to the monitoring and compliance controls of the pollutants emitted by gases from the incinerator in many low to middle income countries. The pollution from the incinerators has a serious impact on the people living in the vicinity as they get affected by particulate pollution and contamination of their food and water sources.

Furthermore, Stringer (2011:7) notes that most low to middle income countries do not have regulatory frameworks governing the safe management of HCW at national level. Some of the countries have developed some policies and guidelines but they do not implement them. In the United States of America (USA), a medical waste tracking act of 1988 was drafted and implemented after an incidence whereby both the HCW and municipal waste got washed up at the Northeast states coast in 1987 (Stringer 2011:7).

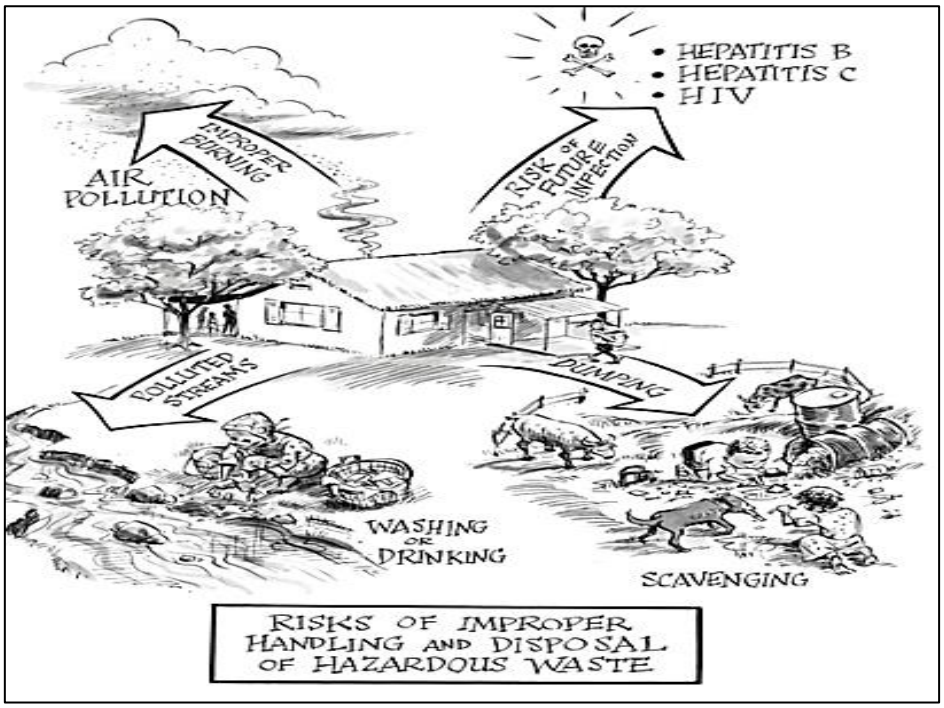


Figure 2.15: Risks from HCW

(Adapted from the USAID, DELIVER 2011:1)

Table 2.3: EXAMPLES OF INFECTIONS WHICH CAN BE CAUSED BY HARZADOUS WASTE

Type of infection	Infective agent	Transmission agent
Gastrointestinal infections	Enterobacteria (*Salmonella, Vibrio cholerae, Shigella*, etc.)	Faeces, vomit
Respiratory infections	*Mycobacterium tuberculosis, Streptococcus pneumoniae*, SARS virus (Severe Acute Respiratory Syndrome), measles virus	Inhaled secretions, saliva
Eye infections	Herpes virus	Eye secretions
Skin infections	*Streptococcus*	Pus
Anthrax	*Bacillus anthracis*	Skin secretions
Meningitis	*Neisseria meningitidis*	Cerebro-spinal fluid
AIDS	Human Immunodeficiency Virus (HIV)	Blood, sexual secretions, other body fluids
Haemorrhagic fever	Lassa, Ebola, Marburg, and Junin viruses	Blood and secretions
Viral hepatitis A	Hepatitis A virus	Faeces
Viral hepatitis B and C	Hepatitis B and C viruses	Blood and other biological fluids
Avian influenza	H5N1 virus	Blood, faeces

(Adapted from Cruz 2011:18)

2.6 LEGISLATION

According to Cruz (2011:28), the following internal agreements were made which prescribe the fundamental principles pertaining to the health of the public, environmental protection and the safe management of hazardous waste:

a) The Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal. The Basel convention aims at minimizing the generation of hazardous waste and encourages the waste to be treated close to its source of production and to reduce trans-boundary movement. The only exception for taking waste across the borders is when the country does not have the proper facilities and expertise to dispose of the waste safely.
b) Bamako Convention (1991), a treaty which was signed by 12 nations to ban the importation of hazardous waste into Africa.
c) Stockholm Convention on Persistent Organic Pollutants which aims at reducing the production of persistent organic pollutants and to eliminate the emissions of harmful substances such as dioxins and furans which cause air pollution (Cruz 2011:28).

According to Pruss-Ustun et al (2014:140), HCW management policies should stipulate or indicate how the health and safety of workers is going to be monitored continuously in order to ensure proper handling, storage, transportation, and disposal procedures. The provision of their health safety measures such as training of staff, immunisation, and supplying adequate personal protective clothing should also be indicated in the policy (Pruss-Ustun et al 2014:140).

In India there is a Bio Medical Waste Management and Handling Rules which was framed in 1998. However people still seem not to adhere to the rules even if they are aware of them (Joshi et al 2015:2).

According to the MoHSS (2011b:8), legislation is a very important tool for the regulation of HCW management. The legislations and regulations of a country should also conform and comply with international regulations which were agreed upon by different waste agreements or international institutions. Namibia is a co-signatory to the Basel Convention, which stipulates the procedures on the trans-boundary movements of waste.

The convention was formed or adopted in 1989 due to concerns about toxic waste being dumped in developing countries but it only came into effect in May 1992. Namibia stated that it would only export waste where the country lacks the expertise or proper facilities to dispose of that waste. For example the radioactive waste is exported to South Africa as Namibia does not have the suitable facilities. This waste should be labelled and transported according to the United Nations (UN) recommendations (MoHSS 2011b:8).

In the Namibian context, national legislations are there to deal with issues of hazardous waste management. However most of the legislations in place are out-dated. According to MoHSS (2011b:8), examples of some national legislation include the following:

1. A proposed Pollution and Waste Management Bill which aims at taking care of hazardous waste in terms of the Environment Impact Assessment processes.
2. A complete National and Regional National Waste Policy.
3. A Draft Public and Environmental Health Bill.
4. Infection and prevention guidelines of March 2010 which regulates the activities of HCW management which include the proper handling and disposal of infectious waste.
5. PEP (Post Exposure Prophylaxis) guidelines of November 2010 which stipulate the administration of PEP when staff members have accidental contact or exposure to infectious blood and body fluids and also in rape cases.
6. The Substance Control Act 13 of 2003 which directs the disposal of unwanted medicines.
7. The National and Regional Environmental Management Act number 7 of 2007 which gives clearance certificates for certain activities, for example disposal site approvals (MoHSS 2011b:8).

According to Muluken et al (2013:319), of the majority of healthcare workers in the studied facilities in Gondar, Ethiopia, about 96.9% of them did not have any form of guideline on the HCW management in their healthcare facilities despite the availability of the Quality and Standard Authority of Ethiopia (QSAE) which was passed in 2004, the Ministry of Health (MOH) guidelines which were put in place in1997 and the WHO guideline manual to ensure safe HCW management.

According to a study by Saat et al (2013:80) which looked into the current status and future challenges of HCW management in Indonesia, the country is facing problems in the safe management of HCW. There are no clear policies to indicate how HCW management should be carried out. Some relevant laws and regulations do exist but there are no relevant policies and guidelines to follow. There is no enforcement from the stakeholders to ensure sustainable HCW management. It is the duty of the government to identify challenges and formulate necessary policy frameworks for managing HCW (Saat et al 2013:80).

2.7 TRAINING

According to Pruss-Ustun et al (2014:140), training in health and safety is one of the important aspects needed for the healthcare workers to know and understand how to manage HCW, the risks it poses, the importance of immunisation and use of personal protective clothing. All healthcare workers who deal with HCW at any given stage are at risk of getting infection and they should receive proper training.

Kumar, Singh, Umesh and Rawat (2015:51) did a study in Pakistan to evaluate the effectiveness of the intensive HCW training model amongst the health professionals of a teaching hospital in Pakistan. They argued that the area of infectious HCW management has always received little attention and it has remained a serious public hazard in many developing countries and as a result there is an issue of environmental pollution which is affecting the entire population. The study results suggested that training on HCW will help improve the knowledge and attitude of healthcare workers regarding HCW management and help reduce the impacts which come with the inappropriate handling of HCW (Kumar et al 2015:51).

According to Pruss-Ustun et al (2014:159), training is needed for the public and healthcare personnel. The public demand for information on the health and environmental effects of HCW has risen due to the prevalence of HIV/AIDS and viral hepatitis B. Healthcare facilities should lead by example and manage their HCW in a proper manner in order to protect the public health and the environment. The community has a right to be fully informed about the potential health hazard posed by improper HCW management. Appropriate handling of HCW should be encouraged amongst community members. Public education should focus on the following aspects:

- Prevention of exposure which can either be out of choice, for example in the case of scavengers or the exposure might be accidental, for example in the case of improper disposal of HCW.
- Awareness creation and instilling a feeling of responsibility among community members.
- To inform the public and hospital patients about hygiene and the importance of HCW management, for example people who live in close proximity to healthcare facilities, patients who are receiving home treatment and scavengers at the dumpsite (Pruss-Ustun et al 2014:159).

The displaying of posters on healthcare issues and issuing of leaflets are some of the methods which can be used to make the public aware of issues of HCW management. Information should be displayed in an attractive manner for it to draw attention. The HCW bins should also be labelled clearly with the type of waste category to be thrown into the bins, and they should be easily accessible. The use of posters with colourful images or diagrams can also help to convey the message of HCW management to those who are illiterate (Pruss-Ustun et al 2014:159).

According to Pruss-Ustun et al (2014:161), training of healthcare workers is very important in order for the HCW management program to be successful. Training will help create awareness on the effects of HCW on the health and environment. It will stipulate the roles and responsibilities of the healthcare workers. The health and environmental awareness are responsibilities of everyone involved in handling HCW. Emphasis of a need for a hospital waste policy should be placed on all categories of healthcare workers and the policy can only be effective if the personnel apply it consistently and with uniformity (Pruss-Ustun et al 2014:161)

Moreover, Pruss- Ustun et al (2014:161) argues that separate training should be done for people in management and administrative positions and another one for medical doctors, nurses, cleaners, porters, auxiliary staff and waste handlers. The training facilitators should do practical trainings with a small group of people and they can test the respondents' knowledge at the end of the course by giving them a test to evaluate what they will have mastered. Follow up refresher courses should also be done to update knowledge on HCW for instance changes in the policy. The training responsibility shall lie

with the infection control officer who will ensure that all healthcare workers are aware of the healthcare facility policy on HCW. The officer should keep records for the proof of training of healthcare workers (Pruss-Ustun et al 2014:161)

According to Pruss-Ustun et al (2014:163), training of HCW handlers should emphasise the following:

- They should always check that all HCW bags or containers are properly sealed to prevent accidental spillages.
- All HCW bags should be labelled with their source of origin, for example operating room.
- They should minimize manual HCW handling and should always pick up the HCW bags by their necks.
- HCW bags should not be in contact with the body of the HCW handler during handling and the HCW collector should not carry more than two bags at a time.
- HCW bags should not be thrown or dropped so as to avoid tearing the bags.
- HCW handlers should wear appropriate personal protective equipment during HCW handling operations.
- In cases of accidental spillages, appropriate cleaning and disinfection measures should be followed.
- All sharp containers should be carried by the handle and they must be supported underneath as sharps may puncture through the sides or bottom of the container (Pruss-Ustun et al (2014:163).

Furthermore, the immunisation against viral hepatitis B and tetanus is recommended for all healthcare personnel and waste handlers (Pruss-Ustun et al 2014:142).

Madhu et al (2013:418) did a study on the enumeration of HCW management at public and private hospitals of Mysore, Karnataka in India. The study used both qualitative and quantitative methods of data collection. The results revealed that out of the 16 different locations studied, both public and private hospitals were found to generate a lot of HCW and that the duty of handling HCW was left to the poorly educated and lowest categories of workers who did not possess any form of training or guidance. Recommendations were given to put more emphasis on health education and HCW handling. It was found that

proper training is also needed, under the strict supervision of the HCW management committee.

In another study by Pinto et al (2014:94), a comparative study was done on the knowledge and attitudes about biomedical waste in an academic hospital. The results revealed that resident doctors and medical interns had more theoretical knowledge of biomedical waste management as compared to the nurses. On the other hand, nurses had more practical experience and knowledge as they worked in the wards most of the time. A significant number of nurses were able to group and match the biomedical waste categories with appropriate colour coded bags and they identified proper disposal methods as per waste category as compared to the medical interns. The knowledge and attitudes of the nurses and doctors were found to vary and they were not satisfactory. A need for a practical orientated training was highlighted and a need for brief contact sessions to sensitize healthcare workers on issues of HCW management was indicated especially at junior level (Pinto et al 2014:94).

2.8 CONCLUSION

Chapter 2 focused on the review of related literature to the study. The literature review adopted the deductive method where literature on HCW management was reviewed from the general to the particular. The review shows that a huge gap exists in the context of HCW management in Namibia. Only a few studies on HCW management in Namibia are available and these were reviewed. None of the studies provided a relevant model on HCW management in the country. Given the existing gap that emerged in the literature search, this study sought to fill that gap and come up with a relevant model that is necessary for HCW management in Namibia.

CHAPTER 3

RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

In the previous chapter, the findings from the various reviewed sources were discussed. The researcher elaborated on the relevant literature relating to the HCW management. This chapter describes the research design and methodology. A detailed description of the research setting, research design, research methods, validity, reliability and ethical considerations are given.

3.2 RESEARCH SETTING

Polit and Beck (2012:743) define a study setting as an exact site and condition or circumstances in which the data collection takes place. This study was carried out at a public hospital and a private hospital in Windhoek, Khomas Region in Namibia. Namibia is situated in the South-western Atlantic coast of the African continent and it borders with Angola, Botswana, South Africa and Zambia. The public hospital is one of the two level three government hospitals in Namibia and the hospital cater for the entire population of Namibia. HCW which is generated in all the other healthcare facilities is sent to the public hospital, since it is the only one with a HCW treatment facility. The public hospital has total bed capacity of about 850, 541 nurses, 110 doctors, 10 pharmacists and 214 cleaners. The private hospital is one of the four private hospitals in the Khomas region with a total bed capacity of 120, 155 nurses, 60 doctors, 8 pharmacists and 55 cleaners.

3.3 RESEARCH DESIGN

According to Polit and Beck (2012:58), the research design is referred to as the master plan for obtaining answers to the research questions. The research design is referred to as the backbone of the study and also indicates the type of data to be collected, how often the data will be collected as well as comparisons to be made and the study location. Grove, Burns and Gray (2013:195) define the research design as clearly defined structures within which the study is carried out in order to achieve accurate results. The

research design should be made to fit a specific study. Grove et al (2013:12) further state that the research design gives the researcher a greater control and it improves the validity of the study. In this study the researcher used a quantitative cross sectional descriptive design to investigate and compare the HCW management practises at the two studied hospitals.

3.3.1 Quantitative design

According to Grove et al (2013:706), quantitative research is a formal, objective, systematic study process to describe and test relationships and to examine the cause and effect interactions among variables. Moreover, Du Plooy-Cilliers et al (2014:14) add that quantitative methods are used to explain relationships and to generalize from a small sample to a large population. Numerical or statistical data are presented through quantitative methods. A quantitative research design was considered to be appropriate for this study because it enabled the researcher to provide statistical evidence of the research variables.

3.3.2 Descriptive design

Grove et al (2013:215) describe descriptive designs as being made in order to gain more information about the characteristics within a particular field of study. Descriptive designs give clarity or a picture of a situation or events as they naturally occur. Descriptive designs may be used to evaluate current practices, make judgements or to check what other people who are in similar positions are doing. Grove et al (2013:215) further state that with a descriptive design, the variables are not manipulated and there is no treatment or intervention given to the respondents. Polit and Beck (2012:226) also share the same definition on a descriptive design, as they posit that the sole purpose of the design is to observe, describe, and document aspects of a situation as it naturally occurs. In this study the researcher used descriptive research to investigate the current HCW management practices in the public and private hospital.

3.3.3 Cross sectional design

Cross sectional design involves the collection of data in a single period (Polit & Beck 2012:184). Brink et al (2012:101) define the cross sectional study as one which is not recurring. It is done at a specific point in time and information is collected once from respondents. The study was cross-sectional because it examined the HCW practices of a public and private hospital simultaneously.

3.4 RESEARCH METHODS

According to Brink et al (2012:201), the aim of the research methods is to inform the reader how the research was carried out; that is, what the researcher did in order to solve the research problem or to answer the research questions. Polit and Beck (2012:13) describe research methods as techniques used to develop a study, and to collect and analyse data relevant to the research question. Population, sampling, data collection and analysis, external validity and ethical considerations of the study ethical issues are described in the following sections.

3.4.1 Population

Polit and Beck (2012:738), as well as Saunders et al (2012:260) describe the population as the whole set of individuals or elements which share common characteristics. A population is said to be all the cases in which the researcher is interested in and it does not only refer to humans, it can be a population of hospital records or blood samples (Polit & Beck 2012:273). Polit and Beck (2012:273) define the accessible population as the cases that fit the designated criteria and are available for a study. The target population is the total number of cases the research findings can be generalized to.

In this study, the target population was represented by all nurses, doctors, pharmacists and cleaners working at a public and private hospital in Windhoek, Namibia. Grove et al (2013:351) define the accessible population as the portion of the target population to which the researcher has access to. The accessible population thus comprised of all nurses, doctors, cleaners and pharmacists who were on duty during the period of data collection. The accessible population was 210.

3.4.2 Sampling

Grove et al (2013:37) describe sampling as a process which involves selecting a group of people or respondents, events, behaviour or other elements to be involved in the study. According to Polit and Beck (2012:275), sampling is a process of choosing cases to represent the whole population so that conclusions about the whole population can be made. Sampling designs are either probability or non-probability sampling. Probability sampling involves the random selection of elements and researchers are able to tell or specify the probability that any element of the population will be selected.
In non-probability sampling, non-random methods are used to select elements and researchers cannot tell the chances that an element has for inclusion in the study.

In this study, the researcher used both probability and non-probability sampling methods. The non-probability purposive sampling method was used to select the study site with an aim to include a predetermined category of a healthcare facility. The researcher chose one public hospital and one private hospital for comparative purposes. Purposive sampling is a non-probability sampling which entails the use of the researcher's knowledge to select people or a site (Polit & Beck 2012:279). Probability stratified random sampling was used to select a sample of respondents from both hospitals. The categories of each profession (nurses, doctors, pharmacists and cleaners) formed a stratum and simple random sampling was done to select a percentage of respondents for each stratum. Stratification helped to make sure that all members of the selected category were well represented. A list of all the healthcare workers (accessible population) was obtained from all the departments to be surveyed in both hospitals. Numbers were assigned to the names of the healthcare workers members that were on duty and they were written on small pieces of papers and placed in a container for each stratum. Simple random sampling was then performed on the names in the container to obtain the respondents for the study. This was done to ensure fairness and also to make sure that the whole population was adequately represented. In simple random sampling, individuals are chosen at random and not more than once to prevent a bias that would negatively affect the study results (Polit & Beck 2012:742).

3.4.3 Sample size

According to Grove et al (2013:708), Polit and Beck (2012:742), Brink et al (2012:217), a sample refers to a subset of a population which includes those selected to participate in a study. Grove et al (2013:708) define a sample size as the number of participants who have given consent to participate and have been recruited in a study. One of the requirements of a quantitative study is to draw a representative sample (Du Plooy-Cilliers et al 2014:135). Botma, Greeff, Mulaudzi and Wright (2010:137) indicate that the sample size should be calculated at the design stage of the study as the sample size will influence the feasibility of the study. Furthermore, Joubert and Ehrlich (2007:102) add that a sample should neither be too large as it may lead to wastage nor should it be too small as it may yield inconclusive results. The overall sample size was approximated as in the formula below:

$$n = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1+\frac{z^2 \times p\,(1-p)}{e^2 N}} \qquad \text{…….. (1)}$$

n = Sample Size for infinite population
Z = Z value (e.g. 1.96 for 95% confidence level)
p = population proportion (expressed as decimal) (assumed to be 0.5 (50%)
e = Margin of Error at 5% (0.05)
N = Population Size

So for a population of 278 at 7% margin of error, the overall sample size (n) is given (using 1) as

$$n = \frac{\frac{1.96^2 \times 0.5\,(1-0.5)}{0.07^2}}{1+\frac{1.96^2 \times 0.5\,(1-0.5)}{0.07^2 \times 218}}$$

= **115 respondents**

stratification sampling formula.

$$n_h = \left(\frac{N_h}{N}\right)n \qquad \text{…… (2)}$$

Where,

n_h is the sample size for the stratum h, N_h Population size for stratum h, N is population size and *n* is the overall sample size. Applying (2), the following table of sample sizes was generated.

Table 3.1: SAMPLE SIZE

Strata	**Private hospital**		**Public hospital**	
	Population	**Sample**	**Population**	**Sample**
Doctors	60	25	110	16
Cleaners	55	23	214	30
Nurses	155	64	541	79
Pharmacist/ass	8	3	10	3
		115		128
Population	**278**		**875**	
Sample		**115**		**128**

3.4.4 Eligibility criteria

Grove et al (2013:352) refer to eligibility criteria as a list of specific characteristics which are required for a membership or eligibility in the target population for study. Polit and Beck (2012:726) define eligibility criteria as a standard which defines a specific list of characteristics of a target population by which people are selected for inclusion in a study.

3.4.5 Inclusion criteria

According to Polit and Beck (2012:353), the inclusion criteria refers to characteristics which a subject or element should have in order to be part of the target population. In this study the nurses, doctors, pharmacists and cleaners who were on duty and were willing to participate were included in the study. The departments included were medical ward, intensive care unit, theatre, emergency centre, surgical ward, paediatric ward and maternity ward.

3.4.6 Exclusion criteria

According to Polit and Beck (2012:353), the exclusion criteria refer to the characteristics that can cause an element or person to be removed from the target population. In this study all nurses, doctors, pharmacists and cleaners who were not willing to participate in the study were excluded from the study. Other healthcare workers like radiographers, dental nurses, physio-therapists, and care workers were excluded as the researcher wanted to include only those categories of healthcare workers which could be found in the two hospitals for comparative purposes.

3.4.7 Data collection procedure

Polit and Beck (2012:175) describe data collection as the gathering of information to address a research problem. Data collection is one of the most important aspects of any research study (Du Plooy-Cilliers et al 2014:147). The researcher used the quantitative approach for data collection. The data collection instruments used were self-administering questionnaires, observation checklist and hospital records.

3.4.8 Data collection instruments

3.4.8.1 Questionnaires

The researcher developed a questionnaire which had questions which were made to assess respondents' knowledge and practices in various aspects of HCW management. The researcher used information obtained from the WHO standard guidelines, Namibia Waste Management Policy, Namibia Integrated HCW Management Plan and the Healthcare Risk Waste Management Directives of Namibia in formulating questions which were put together to develop a questionnaire. The researcher formulated the questions based on the actual standards stipulated in the above mentioned documents.

The questionnaire was divided into four sections. Section A consisted of the demographic data. Personal related characteristics included age, gender, hospital department, work experience, and job category. Section B consisted of questions which captured the knowledge of respondents on HCW management practices; that is questions which involved the HCW generation, handling, segregation, storage and transportation. Section C involved the HCW management and training. Potential impacts of HCW were put in the

last section, section D. The total numbers of questions were 37 and the approximate time for completing the questionnaire was approximated at 25 to 30 minutes.

3.4.8.2 Pretesting

According to Polit and Beck (2012:296), researchers who develop a new instrument should pre-test the instrument in-order to evaluate it and modify or refine it. Pre-testing also helps the researcher to estimate the time required for questionnaire administration. It also helps to identify parts of the instruments which are difficult for the respondents to comprehend and interpret. Pre-testing also helps to check the sequence and logical flow of questions and identify questions which are inappropriate for the respondents. Last but not least pretesting of instruments helps to evaluate the training needs of data collectors.

In this study, the researcher pre-tested the questionnaire using 30 respondents from all strata; that is, questionnaires were distributed using the stratified random sampling to doctors, nurses, pharmacists and cleaners. The researcher sampled the respondents in May 2016 after receiving ethical clearance from the department of health studies at UNISA and also permission to conduct research from the Ministry of Health and Social Services (MoHSS) and also a go ahead verbal permission from the researcher's supervisor.

A pilot study is a small scale version or trial run done in preparation for a major study, which is sometimes referred to as a feasibility study (Polit & Beck 2012:737). In this study, the pilot study was done in five days in the two hospitals. After the pilot study, a few modifications were done to the questionnaire to suit the respondents' level of understanding. Minor changes were made to the 'yes' or 'no' responses. The 'do not know' response was added and also the option 'others specify' was also added to the questions which were testing respondents' knowledge. The researcher also noted that the surgical ward had been omitted in the list of departments and this was then added. The respondents who participated in the pilot study together with the pilot study results were not included in the final study report.

Questionnaires are a list of questions which are answered by the respondents and which give indirect measures of the variables under investigation. Questions can be asked either by interview or self-administration. Self-administration requires the respondents to fill in

the questionnaires themselves (Joubert & Ehrlich 2007:107). The advantages of a survey that involves the use of self-administered questionnaires include:

- They are relatively inexpensive
- They consume less time as compared to other data collection methods
- The questionnaire can be filled in anonymously, which tends to encourage respondents to respond to sensitive issues
- Data can be standardised
- A large amount of data can be collected at one given time

(Du Plooy-Cilliers et al 2014:160).

In this study, self-designed questionnaires were prepared and distributed to the sampled healthcare workers at the two hospitals in different departments under investigation. The questionnaire was used as a tool to assess the level of knowledge and awareness of healthcare workers with regards to HCW management.

3.4.8.3 The Data collection process

The data collection process occurred in the whole month of June 2016. Data was collected concurrently in both hospitals. The researcher reported at the management offices first before going into the various departments to make sure that they were aware of the researcher's presence at their hospital. All the unit heads were informed about the researcher's presence in the hospital and this helped a lot to foster cooperation from the respondents. The questionnaires were distributed by the researcher and the unit heads collected them on behalf of the researcher. The questionnaires were administered by the researcher through a pick and drop method. The researcher collected the completed questionnaires at the healthcare facilities after an agreed time period.

3.4.8.4 Site visits and observation checklist

According to Saunders et al (2012:340), observation involves the systematic observation, recording, description, analysis and interpretation of the people's behaviour. Observations are appealing because of their ability to capture a record of behaviours and

events. Shortcomings of observations include behaviour distortions when respondents become aware of being observed, this is a problem called reactivity. The problems can be eliminated if observations are made without people's knowledge but this type of concealment poses ethical concerns because of the inability to get a truly informed consent (Polit & Beck 2012:189).

In this study, site visits and observations were carried out in the different departments of the two hospitals, which are surgical, medical, paediatric, maternity, pharmacy, intensive care unit (ICU), theatre and casualty. The researcher also carried out observations at the treatment site which is situated at the public hospital and also at the landfill site where the final disposal of HCW is done. The researcher was looking at the following aspects:

- Handling of waste: healthcare workers were observed to see how they were handling HCW and to check whether they were following appropriate and prescribed measures.
- Segregation: the researcher observed whether colour coded bags were being used and whether HCW was being separated according to its nature, for example all infectious waste should be placed in red bags while general waste goes into the black bags.
- Storage: the researcher did observations to check for the availability of a temporary storage area and also to see whether the storage area met the prescribed criteria as stipulated in the national waste policy. The researcher also took some pictures of the status of the storage areas observed.
- Collection and transportation: the researcher observed how HCW was loaded, transported and had a chance to look at the documents required when transporting HCW to a treatment facility.
- Final treatment and disposal: the researcher visited the treatment and disposal site and observed the activities which were being carried out. The researcher also took pictures of some aspects of interest. See Chapter 4 for more details.

These site visits and observations were done to supplement the information gathered in questionnaires.

A checklist was formulated by the researcher to use it as a tool to observe the actual practices of HCW management. The information from the WHO guidelines and Namibia Waste Policy and Healthcare Risk Waste Management Directives was utilised in order to

develop a checklist which is in line with the recommended standards and guidelines of the country. The healthcare facilities were assessed against the standard practices as stipulated in the HCW policy and guidelines. The researcher observed all the HCW management practices from HCW generation, handling, storage, transportation, treatment and disposal.

3.4.8.5 Review of healthcare waste records

The data from the existing files helps the researcher to have some background knowledge and information of what has been done and the current HCW management. The researcher reviewed the HCW monitoring tools, HCW registers, transport registers, vaccination records, training records, hospital policy, infection control guidelines and the National waste policy of Namibia.

3.4.8.6 Reliability of the data collection instruments

Reliability and validity

According to du Plooy-Cilliers et al (2014:254), reliability and validity are ensured through random sampling, having large sample sizes and reliable research tools. Reliability is linked to the findings of the research. If the research method or instrument is reliable, the same result would be produced if the research had to be repeated by a different researcher at a different time using the same instrument. Reliability refers to the fact that different research respondents being tested by the same instrument at different times should respond identically to the instrument (Du Plooy-Cilliers et al 2014:254).

Types of reliability

Stability

In order to establish stability the same respondents are used but the method or instrument is established at different times (Du Plooy-Cilliers et al 2014:256).

Consistency

Consistency is a measure of how consistently each item measures the same thing. To establish consistency one should correlate the performance on each item with the performance across respondents (Du Plooy-Cilliers et al 2014:256).

Equivalence

In order to establish equivalence, the instrument is split into two equivalent halves and then correlates the scores together (Du Plooy-Cilliers, et al 2014:256).

3.4.8.7 Validity of data collection instruments

According to Babbie (2010:153), validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration. Validity therefore simply implies that the instrument actually measures what it is intended to measure (Du Plooy-Cilliers et al 2014:256).

Content validity

Content validity is defined as the degree to which an instrument has an appropriate sample of items for the concept being measured or investigated. It deals with the question of how the construct domain is adequately covered and how representative are the test questions (Polit & Beck 2012:336). In this study, content validity was ensured through the help of the statistician and the study supervisor who read the questionnaire and made comments on how to refine it and make the questionnaire valid.

Face validity

Face validity refers to whether the instrument looks like or appears like it is measuring what it is supposed to measure , that is measuring the target construct (Polit & Beck 2012:336).In this study, face validity was ensured by only putting carefully selected items which reflected the dependent variable (HCW management) in the questionnaire.

Construct validity

Construct validity is referred to as a key measure for assessing the quality of the study. Questions like what is this instrument really measuring are often asked. Construct validity concerns inferences from the particular exemplars of a study to the high order constructs that they are intended to measure (Polit & Beck 2012:256). In this study construct, validity was ensured by making sure that the instrument used contains relevant information related to measurement of health care waste management in hospitals from the point of generation to the last point of disposal.

3.4.9 Data analysis

According to Polit and Beck (2012:739), quantitative data analysis is the manipulation of numeric data through statistical procedures for the purpose of describing phenomena or assessing the magnitude and reliability among them. Survey data analysis is a process that involves five steps: data validation, response partitioning, coding, standard analysis, ordinal and nominal data analysis. After administering the questionnaires, the researcher and the statistician checked data for completeness. The responses from the respondents were managed to ensure that they were consistent to the questions posed. Data were coded and then placed into electronic data files. There was a need to identify similar responses for the open ended questions before identifying the percentage of responses per question by analysing the meaning of each response to the given question.

Data capturing, coding, validation and analysis was done using SPSS version 23.0 and Ms Excel 2010. Charts, tables and graphs were used to present and summarise the responses from questionnaires. For this survey data, exploratory statistical data analysis was done, complimented by descriptive analysis that involved analysing frequencies of responses, mean, maximum, minimum and modal responses.

3.4.9.1 Data cleaning

Data cleaning is performed by identifying outliers, incomplete data and errors during recording (Polit & Beck 2008:644-645). It involves checking for outliers as well as wild codes. Outliers are those values which lie or fall out of range and can be found by inspecting frequency distributions whereby the focus is placed on the lowest and highest values. Some of the outliers are true values whilst some are as a result of data entry errors. Wild codes are those codes which are not possible. Another data cleaning

procedure involves consistency checks, which focus mainly on internal data consistency. Researchers check for errors by testing the compatibility of data within a case (Polit and Beck 2012:465). In this study data was cleaned by doing a trial run of analysis, checking the entries if they corresponded with the items and sub items in the questionnaire. Where discrepancies were observed, the original questionnaire was consulted and corrections were made prior to the actual and conclusive analysis.

3.4.9.2 Descriptive data analysis

This is the analysis of data that helps to describe, show or summarise data in a meaningful way, showing patterns that emerge from the data (Polit & Beck 2008:752). The three main features that researchers use to describe and summarise data are frequencies, measures of central tendency (mean, median and mode) and measures of dispersion such as the range and standard deviation (Mubazi 2012:127) Descriptive statistics describe essential features of data analysis, namely to reduce or summarise, organise and give meaning to collected raw data. Analysis techniques depend primarily on the research design and the level of measurement achieved by the research instrument. For this study, descriptive data analyses were done. Responses to open-ended items were grouped and analysed quantitatively. The actual survey data were analysed using a mixture of exploratory (cross tabulations, bar charts and pie charts, descriptive and non-parametric inferential statistics (Pearson's Chi-square tests). In order to analyse and make conclusions using the Pearson test, certain conditions have to be met, and these conditions are that each observation is independent of all others (that is one observation per subject) and that "no more than 20% of the expected counts are less than five and all the individual expected counts are 1 or greater" (Yates, Moore & McCabe 1999:734).

3.4.9.3 Inferential data analysis

Inferential statistics are concerned with making predictions or inferences about a population from the observations and analysis of a sample (Babbie 2010:476-477). This means inferring the results obtained from a sample to the population from which this sample had been randomly selected. Polit and Beck (2012:404) define inferential statistics as statistics which are used to estimate the population parameters from sample statistics. Polit and Beck (2012:204) further state that the inferential statistics provide a

frame work for making objective judgments about the reliability of the sample estimates. This research was a quantitative, descriptive correlational study that was conducted to describe how healthcare workers are managing HCW.

3.5 VALIDITY AND RELIABILITY OF THE STUDY

Reliability is about the credibility of the study and it is linked to the findings of the research. If the research methods or instruments are reliable, the same result would be repeated by a different researcher at a different time using the same instrument. Validity involves determining whether the research instrument measures what it is supposed to measure (Du Plooy-Cilliers et al 2014:254, 256). In this study the researcher used a large sample to ensure adequate representation and also the pre-testing of the instruments which was done before the actual study commenced. Validity testing of the questionnaire was done using data from the pilot study by using Pearson's product moment correlations done by correlating the item questionnaire with total scores. Reliability of the measuring instrument (questionnaire) was done using Cronbach's Alpha item analysis method. This was done to assess the degree of internal consistency of scores from a set of indicators (questionnaire items) and to assess whether the questionnaire item scales consistently reflect the constructs they are purposed to measure.

3.6 ETHICAL CONSIDERATIONS

Saunders et al (2012:249) define research ethics as the standards of behaviour that guide conduct in relation to the rights of those who become the subject of the research or are affected by it. In this study, moral values were respected and honesty in data presentations was exercised. According to Botma et al (2010:17), all the three principles namely respect for people, justice and beneficence are applicable during the data collection phase.

According to Polit and Beck (2012:152), the Belmont report stipulates three broad principles which are beneficence, respect for human dignity and justice. All these ethical principles were honoured in this study as reflected below. The principle of justice and respect for human dignity are the most applicable in sampling.

3.6.1 Permission for the study

The research proposal was submitted to the University of South Africa (UNISA) Research and Ethics Committee Department of Health Studies and an ethical clearance certificate was issued (see Annexure A). The researcher secured permission to conduct the study at the MoHSS and from the two hospitals involved in the study. The researcher also got permission to visit the incinerators and landfill site. The researcher visited the management team and the various departments for introductory purposes before the study commenced. Informed consent was also obtained from the respondents before data was collected.

3.6.2 Principle of justice

It involves the respondents' right to a fair treatment and selection. The researcher should select the respondents based on the study requirements and not on the group's vulnerability (Polit & Beck 2012:155). According to Grove et al (2013:173), the selection of respondents and their treatment should be carried out in a fair manner. Grove et al (2013:173) add that in the past there was injustice in respondent selection based on social, cultural, racial and sexual biases in the society. Grove et al (2013:173) emphasise that the selection of the population and the specific respondents should be fair and that all risks and benefits should be equally and fairly distributed on the basis of respondents' efforts, needs and rights. Grove et al (2013:173) further add that respondents should be added based on the study problem and not on their availability or their compromised position or manipulability. The other problem with respondent selection is the researcher's bias. Some researchers select certain respondents because they like them and want them to receive the specific benefits of a study, and other researchers are attracted by money and power to select certain individuals as respondents so that they can receive potential beneficial treatment.

In this study, the researcher ensured a fair selection of respondents by doing a simple stratified random sampling, ensuring that each individual in each stratum had an equal chance of being selected. The respondents were all selected for study reasons and not because of their availability. The respondents answered similar questions to ensure fairness.

3.6.3 Principle of respect for human dignity

This principle includes the right to self-determination and the right to full disclosure. The right to self-determination means that the prospective respondents have a right to voluntarily decide to take part in the study or to refuse to give information and or withdraw from the study. The respondents have the right to ask questions as well and to be answered truthfully. Full disclosure means that the researcher fully explains the nature of the study, the likely risks and benefits, the role of the researcher and the right to refuse participation (Polit & Beck 2012:154). Polit and Beck (2012:153) further add that at times full disclosure is not always that straight forward as it can create biases and sample recruitment problems. The researchers can use covert data collection referred to as concealment which is the collection of data without respondents' knowledge and consent. This can happen when the researcher wants to observe people's behaviour in the real world setting and is worried that if he/she does it openly it would affect the behaviour of interest under study. Other concealed methods of obtaining information include videotaping or research observing people while pretending to be busy with other activities. In this study, respondents were fully informed about the study and participation was voluntary and consent was sought.

3.6.4 Rights of institutions

Ethical clearance was sought from the Research and Ethics Committee, Department of Health Studies, UNISA. An ethical clearance certificate (see Annexure A) was issued from UNISA. The certificate was attached to all the application letters which were sent out to the MoHSS, to the two hospitals under study and to the city of Windhoek to seek permission to conduct the study (see Annexures B and C).

3.6.5 Scientific integrity of the study

Ethical conduct in research involves efforts to maintain high standards of integrity and avoid any form of research misconduct like plagiarism, fabrication of results or falsification of data (Polit & Beck 2008:191).The integrity of the study was ensured by producing original data and authentic results. Proper analysis of the data was done with the support of an experienced statistician. All consulted sources were acknowledged in

the text of this thesis and reflected in the list of references of this thesis. The researcher ensured that contributions of the research supervisor, the statistician, the language editor and all who contributed to this study were acknowledged. All these efforts helped to ensure that the principle of scientific integrity of this study was upheld.

3.6.6 Ethical considerations related to data collection

3.6.6.1 Principle of respect for people

Anonymity and confidentiality should be observed always. With confidentiality, only the researchers directly involved in the study will have respondents' personal information and this information should not be shared to anyone without the respondents consent. The person who receives and accepts information in confidence has a duty to maintain the confidentiality (Botma et al 2010:17). Burns and Grove (2009:195) describe privacy as an individual's right to determine how and under which circumstances should personal information be shared or withheld from others. Du Plooy-Cilliers (2014:268) adds that anonymity is the most secure way of protecting confidentiality. When the respondents are promised anonymity, it means that the researchers will not record their names at any stage of the research process and that they will not be able to match their identities to their response in any way. When study respondents are assured confidentiality, researchers undertake that even though they will be able to match the respondent's identities to their research responses, the information will only be known to the researcher (Du Plooy-Cilliers et al 2014:268).

In this study anonymity was ensured by issuing questionnaires without any name attached to them and the informed consent from the respondents were kept separately from the questionnaire to make sure that the signed consent does not link with the completed questionnaires. The questionnaires were kept under lock and key. Only the researcher and statistician had access to the completed questionnaires.

3.6.6.2 Principle of justice

According to Botma et al (2010:19), the principle of justice means that all respondents should receive fair treatment. The researcher should adhere to the research protocol and information provided in the information leaflet. The researcher cannot carry out new

procedures or techniques or add new interventions which were not described in the brochure to be carried out. If the researcher decides to use new methods or techniques, the researcher has to obtain a new informed consent from the respondents. It is very unfair or unjust to gather data without the respondents' knowledge as it violates their privacy, for example video recording of the observations done through a one way glass. This type of data collection is referred to as concealment or covert and is only permissible where the risks are minimal and the respondents' privacy is not violated.

3.6.6.3 Beneficence

The principle of beneficence implies that a person has the right to be protected from harm and discomfort and one should do well and avoid harm at all costs (Botma et al 2010:20). The principle imposes a duty on the researcher to minimise harm and maximise benefits (Polit & Beck 2012:152).

In this study there was no perceived harm to the respondents. The researcher also got informed consent from respondents before collecting the data. The researcher visited selected study sites for introductory purposes and to explain the purpose of the study. The respondents were informed that participation was out of free choice and that they were free to withdraw from the study at any given point without having an obligation to the researcher. The researcher obtained informed written consent from the respondents after the respondents had read and understood the contents of the informed consent and had opportunities to ask questions where they did not understand. The researcher assured the respondents that confidentiality was going to be maintained throughout the study and did not promise any stipends for those who agreed to participate. Respondents were informed that on completion of the study, the findings would be submitted to the MoHSS and another copy would be available in the UNISA library and UNISA electronic repository for further reference.

With regards to documents review, the researcher first sought permission from the relevant authorities. Documents like the infection control guidelines of Namibia, National Waste Policy, HCW registers, and HCW monitoring tools were reviewed. Information which was obtained from the records was treated in confidence and used for research purposes only.

3.7 CONCLUSION

This chapter gave a comprehensive description of the research design and methods. The description incorporated sampling issues, data collection, data analysis and ethical considerations.

CHAPTER 4

ANALYSIS, PRESENTATION AND DESCRIPTION OF THE RESEARCH FINDINGS

4.1 INTRODUCTION

The purpose of the current study was to investigate the HCW management practices at a public and private hospital in Khomas region, Namibia and consequently to be able to develop recommendations related to HCW management in the country. The study was conducted using self-administered questionnaires and observation checklists. The findings from the data analysis are presented in this chapter.

4.2 ACTUAL SURVEY ANALYSIS

As discussed in Chapter 3, a quantitative descriptive survey design was used to address the study objectives. A total of 210 employees for both the private and public hospitals completed and returned the questionnaires. All the questionnaires were considered for analysis.

The actual analysis was done in the following categories; demographic information (4.2.1) HCW management practices which involve segregation; handling; storage; transportation and disposal (4.2.2), HCW management and training (4.2.3) and potential impacts of HCW (4.2.4).

4.2.1 Demographic information

The sample consisted of two hospitals, public hospital and private hospital. Demographic information for these two hospitals was summarized and compared to see if it was statistically independent of stratum. This information helped the researcher to understand gender, age, work experience groups, job categories and respective departments where these survey respondents belong. Table 4.1 below indicates that the majority of respondents were females 77|106 (72.6%) for the public hospital and 78|104 (75%) for the private hospital respectively. Male respondents were slightly above a quarter 29|106

(27.2%) for the public hospital and exactly a quarter 26|106 (25%) for the private hospital. The majority of the survey responses for both hospitals indicated that there were more female (Appendix II, Figure A1) than male responses.

This is similar to a study done by Bin and Hai (2014:2590) where most respondents were females. In another study by Azuike et al (2015:114), there were more males (54.1%) as compared to females (45%). This gender representation was in contrast with that of this study.

Table 4.1: DEMOGRAPHIC INFORMATION OF THE RESPONDENTS (N=210)

Characteristics		Public			Private		
		Frequency	Percentage (%)	Cumulative (%)	Frequency	Percentage (%)	Cumulative (%)
2. Gender	1	77	72.6	72.6	78	75.0	75.0
	2	29	27.4	100.0	26	25.0	100.0
3. Age bracket	21-30	35	33.0	33.0	34	32.7	32.7
	31-40	39	36.8	69.8	28	26.9	59.6
	41-50	19	17.9	87.7	20	19.2	78.8
	51-60	9	8.5	96.2	18	17.4	96.2
	over 60	4	3.8	100.0	4	3.8	100.0
4. Work Experience	< 1 year	32	30.2	30.2	31	29.8	29.8
	1-5 years	31	29.2	59.4	30	28.8	58.7
	> 5 years	43	40.6	100.0	43	41.4	100.0
5. Department	casualty	9	8.5	8.5	15	13.5	13.5
	ICU	16	15.1	23.6	10	9.1	22.5
	Maternity	12	11.3	34.9	14	12.6	35.1
	Medical	20	18.9	53.8	15	13.5	48.6
	Pediatric	16	15.0	68.9	11	9.9	58.6
	Pharmacy	4	3.8	72.6	3	2.7	61.3
	Theatre	14	13.2	85.8	27	24.3	85.6
	Surgical	15	14.2	100.0	16	14.4	100.0
6. Job Category	Registered Nurse	47	44.4	44.3	38	35.8	35.8
	Enrolled Nurse	23	21.7	66.0	20	18.9	54.7
	Doctor	12	11.3	77.4	1	10.9	55.7
	Pharmacist	2	1.9	79.2	20	18.9	74.5
	Cleaner	21	19.8	99.1	3	14.6	77.4
	Pharmacist assistant	1	.9	100.0	1	.9	78.3

4.2.1.1 Demographic characteristics

The age distribution within the workforce was analysed and the responses show that the majority of the healthcare workers were within the age brackets of 21-30 years and 31-40 years (Appendix II, Figure A2) in both hospitals. According to Table 4.1 above, very few respondents 4|106 (3.8%) for the public hospital and 4|104 (3.8%) for the private hospital were over 60 years and a few 9|106 (8.5%) for the public hospital and 18|104 (17.3%) for the private hospital were within the 51-60 years range. Quite a few 19|106 (17.9%) and 20|104 (19.2%) were in the age bracket of 41 - 50 years for the public and private hospitals respectively.

The Chi-Square test (Table A5 below) testing the null hypothesis that there is no statistically significant difference in the relative frequency of age groups across the 2 hospitals showed that there is no statistical significant difference ($p > 0.05$) in relative frequency of age groups across the two hospitals. This means that there is no statistical evidence to deny that age distribution in the public hospital is not different from age difference in private hospital. This is similar to a study undertaken by Bin and Hai (2014:2590) where the median age group was 32.3 and to a study done by Das and Biswas (2016:19) where the majority of respondents belonged to the category of 21 to 30 years.

Table A5: CHI-SQUARE TESTS

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	4.827[a]	4	.305
Likelihood Ratio	4.893	4	.298
Linear-by-Linear Association	1.504	1	.220
N of Valid Cases	210		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 3.96.

The duration of work experience of the respondents in the two hospitals was assessed and they showed an interesting pattern. Most of the respondents 43|106 (40.6%) for

public hospital and 43|104 (41.3%) for private hospital indicated that they had over 5 years of experience (see Table 4.1 above and Figure A3 below). Almost an equal percentage of respondents indicated that they had between 1 and 5 years of experience and less than 1 year experience. This trend is the same across the two hospitals as this was ascertained by the Chi-Square test (Appendix II, Table A6) which showed no statistical significant differences ($p > 0.05$) in relative frequency of work experiences across the two hospitals. These similarities helped to ensure a sort of an equal base for comparative purposes and also enabled generalisability of findings since respondents had similar years of experience. In terms of HCW management, the more years in the hospital might imply more knowledge or experience in handling HCW.

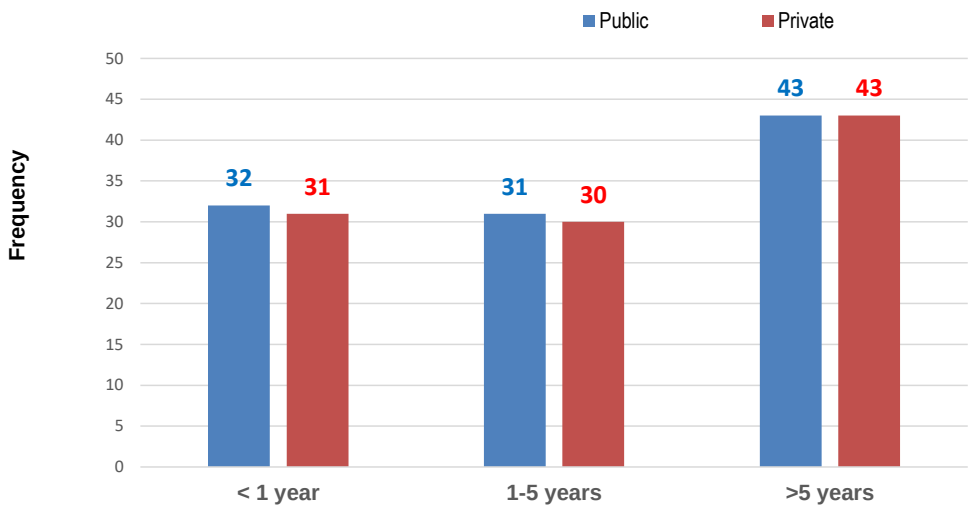


Figure A3: Work experience

The analysis done per department indicated that there was a fair representation by all departments (see Appendix II, Figure A4). According to Table 4.1 above, the majority of the responses 27|104 (24.3%) indicated that they were from theatre department for the private hospital and from medical ward 20|106 (18.9%) for the public hospital. Very few 3|104 (2.7%) for the private hospital and 4|106 (3.8%) for the public hospital were responses from pharmacy. There were not many differences in frequencies in the rest of the departments. Using Pearson's Chi-square test statistic (Table A7, Appendix II) the researcher failed to reject the null hypothesis and concluded that there were no statistical significant differences in relative frequencies of departments across the two hospitals. This implies that there was a fair representation of departments across the two hospitals.

Responses on job category showed that the majorities were registered nurses followed by enrolled nurses, doctors and cleaners for both hospitals (see Figure A5 below and Table 4.1 above). The category of nurses was high, maybe due to the fact that nurses form the greater part of healthcare workers in almost every healthcare setting.

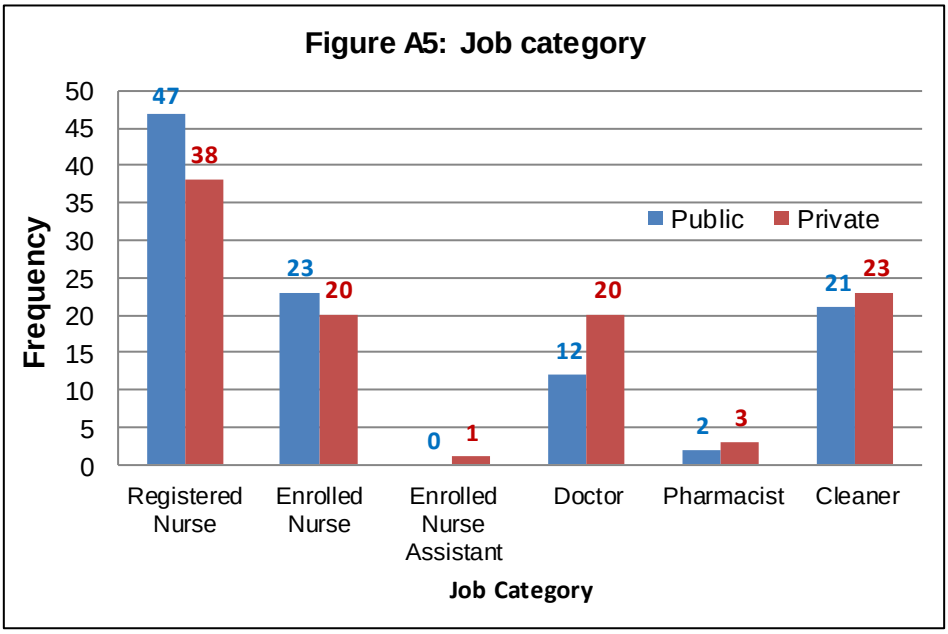


Figure A5: Job category

4.2.2 HCW management practices

HCW management is a process which involves several steps, that is segregation, collection, transportation, storage and treatment of waste. In this section, an assessment of how healthcare workers handle HCW was done and results are presented in Table 4.2 below.

Table 4.2: HCW MANAGEMENT (N=210)

Characteristics		Public			Private		
		Fre-quency	Percen-tage (%)	Cumula-tive (%)	Fre-quency	Percen-tage (%)	Cumula-tive (%)
7. Types of wastes	infectious	85	26.7	26.7	89	28.5	28.5
	Anatomical	25	7.9	34.6	31	9.9	38.5
	Sharps	85	26.7	61.3	75	24.1	62.5
	Pharmaceu-tical	28	8.8	70.1	24	7.7	70.2
	Chemical	13	4.7	74.2	12	3.8	74.0

Characteristics		Public			Private		
		Fre-quency	Percen-tage (%)	Cumula-tive (%)	Fre-quency	Percen-tage (%)	Cumula-tive (%)
	General	80	25.2	99.4	78	25.0	99.0
	Radioactive	2	1.8	100.0	3	2.8	100.0
8. Healthcare waste segregation	Strongly Disagree	5	5.6	5.6	2	2.1	2.1
	Disagree	2	2.2	7.8	7	7.4	9.6
	Neutral	6	6.7	14.4	53	46.3	66.0
	Agree	55	59.3	75.6	32	34.0	100.0
	Strongly Agree	22	24.4	100.0	7	7.4	9.6
9. Who separates HCW in your department?	Nurses	70	32.7	32.7	70	40.1	40.0
	Doctors	34	15.9	48.6	10	5.7	45.7
	Pharmacists	2	.9	49.5	2	1.1	46.9
	Pharmacist assistants	4	1.9	51.4	2	1.1	48.0
	Cleaners	78	36.4	87.9	74	42.3	90.3
	Kitchen staff	12	5.6	93.5	2	1.1	91.4
	laundry staff	5	2.3	95.8	7	4.0	95.4
	Porters	4	1.9	97.7	3	1.7	97.1
	other (specify)	5	2.4	100.0	5	2.9	100.0
10. Colour coding system	Yes	98	93.3	93.3	98	94.3	94.2
	No	4	3.8	97.1	2	1.9	96.2
	Don't know	3	2.9	100.0	4	3.8	100.0
11. Instructive posters	Yes	80	76.2	76.2	74	71.8	71.8
	No	19	18.1	94.3	13	12.6	84.5
	Don't know	6	5.7	100.0	16	15.6	100.0
12. Bags used for infectious HCW	red plastic	100	78.1	78.1	96	80.6	80.7
	yellow plastic	8	6.3	84.4	10	8.4	89.1
	black plastic	14	10.9	95.3	4	3.4	92.4
	other (specify)	6	4.7	100.0	9	7.6	100.0
13.Bags used for general HCW	red plastic bag	19	14.6	14.6	16	14.4	14.4
	yellow plastic	11	8.5	23.1	13	7.2	26.1
	brown plastic	0	0	0	3	2.7	28.8
	black plastic	89	68.5	91.5	66	59.5	88.3
	other (specify)	11	8.4	100.0	13	11.7	100.0
14. Bags used for pharmaceu-tical HCW	red plastic bag	55	61.8	61.8	34	51.5	51.5
	yellow plastic	4	4.5	66.3	8	12.1	63.6
	brown plastic	6	6.8	73.0	10	15.2	78.8
	black plastic	23	25.8	98.9	13	19.7	98.5
	red plastic	1	1.1	100.0	1	1.5	100.0
15. Used for sharps HCW	red plastic	7	6.8	6.8	4	3.9	3.9
	yellow plastic	2	1.9	8.7	0	0	3.9
	brown plastic	0	0	0	0	0	3.9
	black plastic	1	1.0	9.7	0	0	3.9

Characteristics		Public			Private		
		Fre-quency	Percen-tage (%)	Cumula-tive (%)	Fre-quency	Percen-tage (%)	Cumula-tive (%)
	yellow box	88	90.3	95.1	96	93.2	97.1
	other (specify)	5	4.9	100.0	3	2.9	100.0
16. Waste bags subject to tear?	Strongly Disagree	12	11.8	11.8	16	16.5	16.5
	Disagree	43	42.2	53.9	30	30.9	47.4
	Neutral	14	13.7	67.6	22	22.7	70.1
	Agree	21	20.5	88.2	16	16.5	86.6
	Strongly Agree	12	11.8	100.0	13	13.4	100.0
17. Staff wears protective clothing?	Strongly Disagree	10	9.1	9.1	4	4.0	4.0
	Disagree	9	8.2	17.3	4	4.0	8.0
	Neutral	11	10.0	27.3	8	8.0	16.0
	Agree	50	45.5	72.7	63	63.0	79.0
	Strongly Agree	30	27.2	100.0	21	21.0	100.0
18. Type of protective clothing	Gloves	100	38.2	38.2	98	46.9	46.9
	Aprons	67	25.6	63.7	61	29.2	76.1
	Face masks	58	22.1	85.9	25	12.0	88.0
	Goggles	15	5.7	91.6	12	5.7	93.8
	Gum boots	18	6.9	98.5	12	5.7	99.5
	other (specify)	4	1.5	38.2	1	.5	100.0
19. Mode of transportatio n	wheelie bins	24	22.9	22.9	65	49.2	49.2
	wheeled trollies	74	70.4	93.3	59	44.8	93.9
	Carts	6	5.7	99.0	2	1.5	95.5
	other (specify)	1	1.0	100.0	6	4.5	100.0
20. How often is HCW collected	once a day	16	16.2	16.2	4	4.4	4.4
	twice per day	22	22.2	38.4	22	24.2	28.6
	per rising need	55	55.6	93.9	60	65.9	94.5
	other (specify	6	6	100.0	5	5.5	100.0
21. Who collects HCW?	Nurses	6	4.9	4.9	6	5.5	5.5
	Doctors	2	1.6	6.6	0	0.0	5.5
	Pharmacists	2	1.6	8.2	0	0.0	5.5
	Pharmacist assistants	5	4.1	12.3	1	0.9	6.4
	Cleaners	91	74.7	86.9	95	86.4	92.7
	Kitchen staff	4	3.3	90.2	0	0	92.7
	laundry staff	5	4.1	94.3	3	2.7	95.5
	Porters	6	4.9	99.2	3	2.7	98.2
	other (specify	1	.8	100.0	2	1.8	100.0
22. Temporary HCW	Strongly Disagree	8	8.2	8.2	0	0.0	0.0
	Disagree	13	13.4	21.6	4	4.2	4.2
	Neutral	36	37.1	58.8	30	31.3	35.4

Characteristics		Public			Private		
		Fre-quency	Percen-tage (%)	Cumula-tive (%)	Fre-quency	Percen-tage (%)	Cumula-tive (%)
storage area is sufficient?	Agree	27	27.8	86.6	47	49.0	84.4
	Strongly Agree	13	13.5	100.0	15	15.5	100.0
23. Lockable waste storage?	Yes	31	30.1	30.1	64	64.0	64.0
	No	32	31.1	61.2	6	5.6	70.0
	Don't know	40	38.8	100.0	30	30.0	100.0
24. Wastes temporarily stored for how long	24 hours	63	75.0	75.0	55	69.6	69.6
	48 hours	3	3.6	78.6	0	0.0	0,0
	72 hours	1	1.2	79.8	3	3.8	73.4
	Other (specify)	17	20.2	100.0	21	26.6	100.0
25. HCW weighed?	Yes	11	10.7	10.7	53	53.0	53.0
	No	28	27.2	37.9	6	6.0	59.0
	Don't know	64	62.1	100.0	41	41.0	100.0
26. Who collects HCW	Private	17	17.3	17.3	80	85.1	85.1
	Hospital	72	73.5	90.8	6	6.4	91.5
	Other (specify)	9	9.2	100.0	8	8.5	100.0
27. How often is the HCW collected	Daily	71	78.9	78.9	53	63.9	63.9
	Once a week	8	8.9	87.8	11	13.2	77.1
	fortnightly	3	3.3	91.1	1	1.2	78.3
	Once a month	1	1.1	92.2	1	1.2	79.5
	other (specify)	7	7.8	100.0	17	20.5	100.0

According to (Table 4.2) above, in the private hospital, workers seem not to have any idea on whether HCW segregation is done in their hospital departments, but those working for the public hospital seem to confirm that there is HCW segregation in the departments of their hospital. Quite a number of respondents concur that cleaners were the personnel that separates HCW in the departments of each of the two hospitals. Most responses seem to confirm that there is a colour coding system for sorting HCW in each of the two hospitals. Furthermore, most respondents confirmed the presence of instructive posters for HCW segregation in their departments for both hospitals. The most commonly used bags to collect HCWs are red plastic bags for infectious and pharmaceutical HCWs, black plastic bags for general HCWs and yellow boxes for sharps HCWs. It was also confirmed from the responses that HCW collection bags seem not to be subject to tear in both hospitals.

In addition, most respondents agree that healthcare workers wear protective clothing when handling HCW in both hospitals and the most common protective clothing in all hospitals are gloves. In the public hospital, the common mode of transportation of HCW within the hospital was indicated as wheeled trollies and in the private hospital as both wheelie bins and wheeled trollies. Deductions from responses show that HCW are collected as per rising need and these HCW are collected by cleaners for both hospitals. For the private hospital, responses showed that the temporary HCW storage area is sufficient but for the public hospital, the workers seem not sure whether sufficient or not. Responses from the private hospital indicate that the temporary storage area for HCW in the hospital is lockable but for the public hospital responses indicate that the workers are not sure. Both hospitals temporarily store HCW for 24 hours before it is transported to the treatment facility. From the responses, it seems that most healthcare workers have no idea on whether HCW are weighed or not in their hospital for both the public and private hospital. But for the private hospital quite a number have an idea and they indicated that HCW are weighed. Private contractors' transport collects HCW from the private hospital and the hospital transport collects HCW from the public hospital's temporary HCW storage area to the treatment facility and it was also indicated from the responses that both hospitals' HCWs are collected daily.

The researcher wanted to assess how HCW is handled by the healthcare workers in these various departments. Statistical comparison (Chi-square test) of relative response frequency of HCW generated between the two hospitals showed no statistical significance differences ($p > 0.05$) in relative response frequencies across the two hospitals (Table B2, Appendix III).

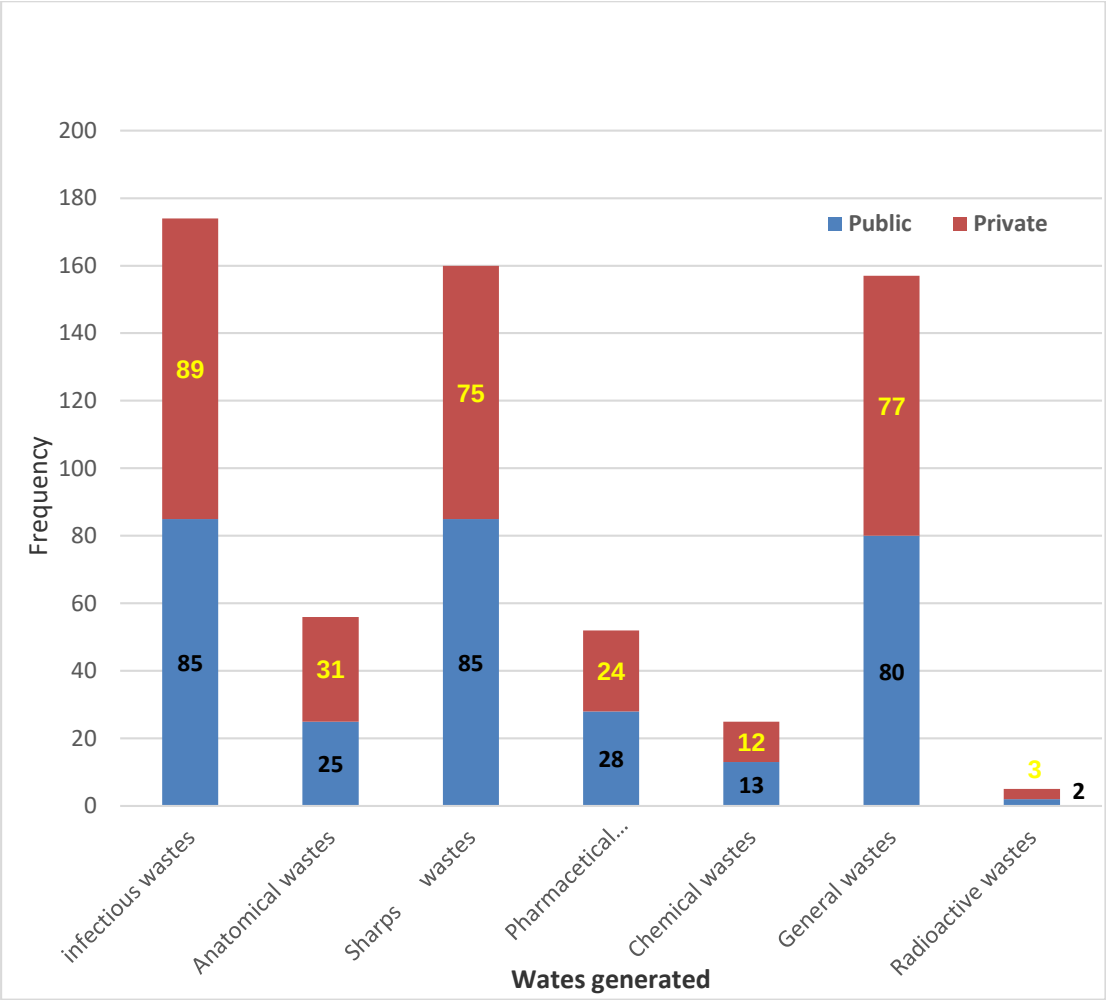


Figure B1: HCW generated in departments

According to Table 4.2 above (and Appendix III, Figure B2), the responses on HCW segregation in departments indicated that healthcare workers agreed 55|106 (61.1%) in public hospital and 32|104 (34%) in private hospital and strongly agreed 22|106 (24.4%) in the public hospital and 7|104 (7.4%) in the private hospital. These results show that there was HCW segregation in departments. Very few responses were negative and some showed that there were healthcare workers who had no idea about this. These findings are similar to the study findings of a study conducted by Abor (2013:375) which indicated that both the public and private hospital segregated HCW.

Table 4.2 above shows that 78|106 (36.4%) and 70|106 (32.7%) at the public hospital and 74|104 (42.3%) and 70|104 (40%) responses from the private hospital indicated that cleaners and nurses separate HCW in both hospitals (Figure B3, Appendix III). Very few pointed out to doctors and almost zero percentage of responses favoured other job

categories like pharmacists with 4|106 (1.9%) from the public hospital stratum and 2|104 (1.1%) from the private hospital. From these responses, it may be generalized that in both hospitals, HCW are separated by nurses and cleaners. Further analysis using Chi-square test to assess whether relative frequencies were significantly different across the two hospitals was not done for the two Items 8 and 9 because assumptions of this test statistics were not valid.

Table B6: CROSSTAB FOR COLOUR CODING SYSTEM

		Item 1		Total
		Public	**Private**	
Item 10	Yes	98	98	196
	No	4	2	6
	Don't Know	3	4	7
Total		**105**	**104**	**209**

The majority 98|106 (93.3%) for the public hospital and 98|104 (94.2%) for the private hospital of the responses on whether there was a colour coding system for sorting HCW in the hospital indicated that a colour coding system existed in the two hospitals (see Table B6 and Table 4.2 above). Very few had no knowledge about it and also very few were negative. This can be a very clear indication that colour coding does exist in the two hospitals. These findings do not tally with a study done by Debere et al (2013:28) who indicated that in all the studied hospitals there was no colour coding used and segregation was not done. A study conducted by Abah and Ohimain (2011:102) in Nigeria also revealed that there was no colour coding done in the studied hospitals and this is in contrast with the current study findings. In a study by Indupalli et al (2015:562), the findings were similar to this study with 92% of the respondents indicating that colour coding was practised in their facility. Plate 4.1 (public hospital) and Plates 4.2a and 4.2b (private hospital) below shows bins with colour coded plastic bags for HCW segregation.

Plate 4.1: Bins lined with different colour coded bags at a public hospital

Plate 4.2a: A bin lined with a colour coded plastic bag at a private hospital

Plate 4.2b: A bin lined with a colour coded bag at a private hospital

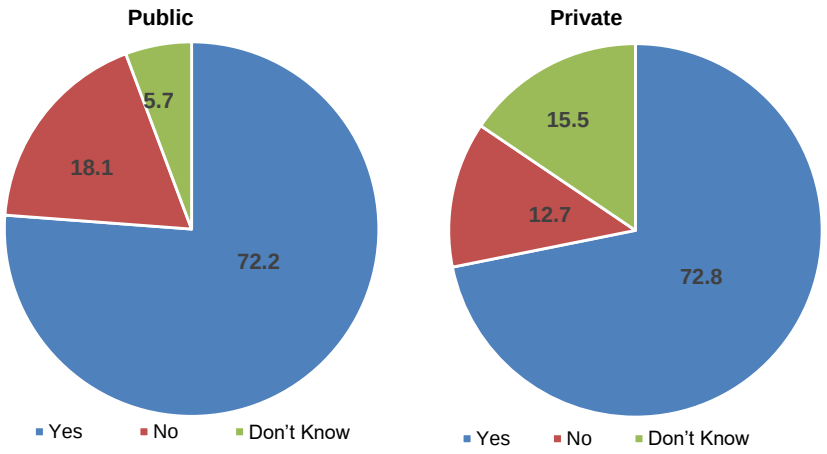


Figure B4: Any instructive posters for HCW segregation?

From Figure B4 above, results from responses showed that the majority were in support of the existence of instructive posters for HCW segregation in their departments in their respective hospitals. About 76.2% (80|106) and 71.8% (74|104) for the public hospital and private hospital respectively agreed that there were instructive posters. Very few did not agree and some in those few had no idea. In light of these responses, it can be confirmed that these posters do exist in these different departments in the hospitals. Further analysis using the Chi-square test (Appendix III, Table B8) showed no statistical significant difference ($p > 0.05$) in relative frequencies of responses for this item across the two hospitals. This study findings are similar to a study by Das and Biswas (2016:23) who reported that 77.3% of healthcare workers new about the presence of instructive posters in their departments. However these study findings differ from the findings of Abah and Ohimain (2011:103) who reported that there were no posters seen anywhere in the studied hospitals. See Plates 4.3a and 4.3b below illustrating the posters found in the public hospital and private hospital.

Plate 4.3a: Instructive poster for HCW segregation for the private hospital

Plate 4.3b: Instructive poster for HCW segregation for both public hospital and private hospital

Different colour coded bags are used to collect different types of HCW in the two hospitals. Bags used to collect infectious, general, pharmaceutical and sharps HCWs were

assessed and the responses indicated that 100|106 (78.1%) and 96|104 (80.7%) of the responses for the public hospital and private hospital respectively indicated that the red plastic bag was used to collect infectious HCW (Table B9 below). Very few responses indicated yellow, black and other bags (not specified). The result of this analysis shows that the red plastic bag is the one commonly used in these two hospitals. The results indicate that the majority of the healthcare workers know the colour codes although a few do not know the colour coding. Both hospitals indicated the red plastic for infectious waste, black plastic for general waste and yellow box for sharps. These findings indicate proper HCW segregation and knowledge of the colour coding system. This is in line with the study conducted in Ghana by Abor (2013:375) who reported good HCW segregation which was carried out by respondents in the study. This was done by first identifying the HCW type and then separating non-infectious or general waste from infectious waste (Abor 2013:375).

Table B9: CROSSTAB FOR BAGS USED FOR INFECTIOUS WASTE.

Count

		Item 1		Total
		Public	**Private**	
Item 12	Red plastic bag	100	96	196
	Yellow plastic bag	8	10	18
	Black plastic bag	14	4	18
	Other (specify)	6	9	15
Total		**128**	**119**	**247**

Most responses pointed out that black plastic bags are the commonly used to collect general HCW. About 89|106 (68.5%) and 66|104 (59.5%) for the public hospital and private hospital respectively (Appendix III, Table B11 and Table 4.2 above) indicated that the black plastic bag is used to collect general HCW. Whereas 23|106 (25.8%) and 13|104 (19.7%) for the public hospital and private hospital respectively of the responses from the survey indicated that the black plastic bag is used for pharmaceutical HCW collection (Table 4.2 above).

Almost all of the responses indicated that the yellow box 88|106 (85.4%) and 96|104 (93.2%) for the public hospital and private hospital respectively were used to collect HCW sharps at the hospital. Very few responses indicated other types of waste collection

media, for instance, 7|106 (6.8%) and 4|104 (3.9%) for the public hospital and private hospital respectively indicated red plastic bags (Table 4.2 above and Appendix III, Table B12).

Tables B10, B12, B14 and B16 in Appendix III show results of Pearson's Chi-Square tests for items which assessed the types of bags used for certain HCW. All test results for these items showed that there were no statistical significant differences ($p > 0.05$) in relative frequencies of responses to each of the items across the two hospitals.

An assessment to find out the tensile strength of the bags was also conducted to check whether the two hospitals used bags of good quality. From the responses, there were mixed opinions on whether HCW bags in the respondents' hospitals were subject to tear or not (see bar chart below, Figure B5). From the distribution of responses on the bar chart (figure B5), it shows that 12% and 16% of the respondents from the public and private hospitals respectively were on the disagreeing side (strongly disagree) and 43% and 30% for the public and private hospitals respectively disagreed that the bags tear easily. Only 21% and 16% agreed that bags tear easily, with 12% and 13% for the public hospital and the private hospital strongly agreeing that the bags can tear. About 14% and 22% for the public and private hospitals were neither agreeing nor disagreeing, they remained neutral. These results may imply that the bags which are used are of a better quality as they do not tear easily.

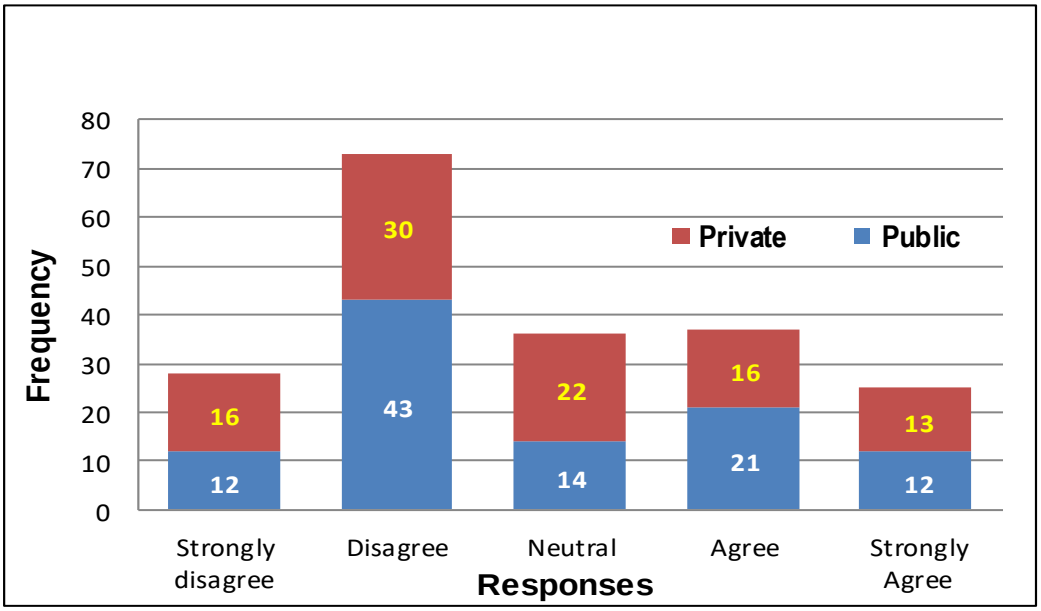


Figure B5: HCW bags' tensile strength

On finding out whether healthcare workers wear protective clothing when handling HCW, information gathered from the responses (refer to Table B19 in Appendix III and Table 4.2 above) show that most of the healthcare workers in the two hospitals were positive that staff wear protective clothing when handling HCW as 55|106 (45.5%) and 63|104 (63%) agreed, 30|106 (27.3%) and 21|104 (21%) strongly agreed for the public hospital and private hospital respectively. The minority were on the negative side. Both Chi-square tests for items 16 and 17 showed that there were no statistical significant differences ($p > 0.05$) in relative frequencies of responses to each of the items across the two hospitals (Tables B18 and B20, Appendix III). These results imply a good practice which is in line with the infection prevention control guidelines of the country.

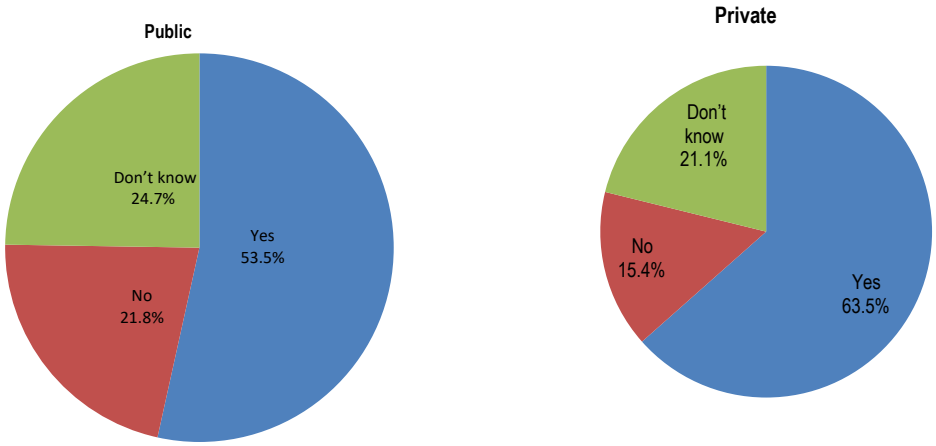
Responses on the enquiry about the type of protective clothing staff wear when handling HCWs in their hospital, Table 4.2 above, indicates the various types which were gloves (38.2% and 46.9%), aprons (25.6% and 29.2%), face mask (22.1% and 12%), goggles (5.7% and 5.7%) and gum boots (6.9% and 5.7%) for the public and private hospitals respectively. It seems from the survey that the most commonly used (Figure B6 below) type of protective clothing were gloves followed by aprons and masks. Goggles and gum boots were used by quite a few according to the responses. These findings are an indication that the healthcare workers make use of personal protective equipment when handling HCW. The proportion of those using gloves is high, maybe due to the fact that gloves are readily available most of the time in the hospital as compared to aprons and masks. Both hospitals gave positive responses on the wearing of protective clothing. These findings are not similar to a study by Bin and Hai (2014:2592) where lack of personal protective equipment was listed as one of the top five barriers for effective HCW management. The type of protective equipment worn was mainly gloves and masks in both hospitals. These findings are similar to the study findings of Das and Biswas (2016:19) where the majority of respondents wore their gloves as personal protective

equipment but these findings are different from the findings from Abah and Ohimain (2011:103) where the personal protective equipment was only limited to the uniforms.

Figure B6: Type of protective clothing

4.2.2.1 On-site transportation of HCW transportation

Responses for the onsite transportation of HCW (Table B23 below), shows that the most commonly used mode of HCW transportation were wheelie bins 24|106 (22.9%) and 65 (49.2%) for the public hospital and private hospital respectively and wheel trolleys 74|106



(70.5%) and 59|1104 (44.7%) in both of the hospitals (Table 4.2 above). Very few used carts and other modes of transportation. These findings were in contrast to the study findings by Bin and Hai (2014:2591) where there was lack of equipment for waste disposal.

Table B24 in Appendix III shows that most responses 55|106 (55.6%) and 60|104 (65.9%) for the public hospital and private hospital respectively pointed out that HCW collection was done as per rising need in their departments. Few respondents in the survey reported that HCW is collected twice a day 22|106 (22.2%) and 22|104 (24.2%) for the respective public and private hospital. This practice is according to the national guidelines. These findings show good HCW management practices and tallies with the findings of Abor (2013:375) where the two hospitals under study adhered to their waste management policy and waste management plans.

Table B23: CROSSTAB FOR MODE OF TRANSPORTATION USED TO FERRY WASTES

		Item 1		Total
		Public	Private	
Item 19	Wheelie bins	24	65	89
	Wheeled trolleys	74	59	133
	Carts	6	2	8
	Other	1	6	7
Total		**105**	**132**	**237**

Responses from (see Table B26, Appendix III) the survey shows that mostly cleaners are the ones who collect HCW 91|106 (74.6%) and 95|104 (86.4%) for the public and private hospital respectively to temporary storage areas. Very few responses pointed out to other workers (between 0-5%) as wastes collectors. Chi-square tests for items 19 and 21 were not done because assumptions of this test are not ascertained. Chi-square test was done for item 20 (Table B25, Appendix III) and the test showed that there were no statistical significant differences ($p > 0.05$) in relative frequencies of responses to how often HCW are collected between the two hospitals.

4.2.2.2 HCW storage

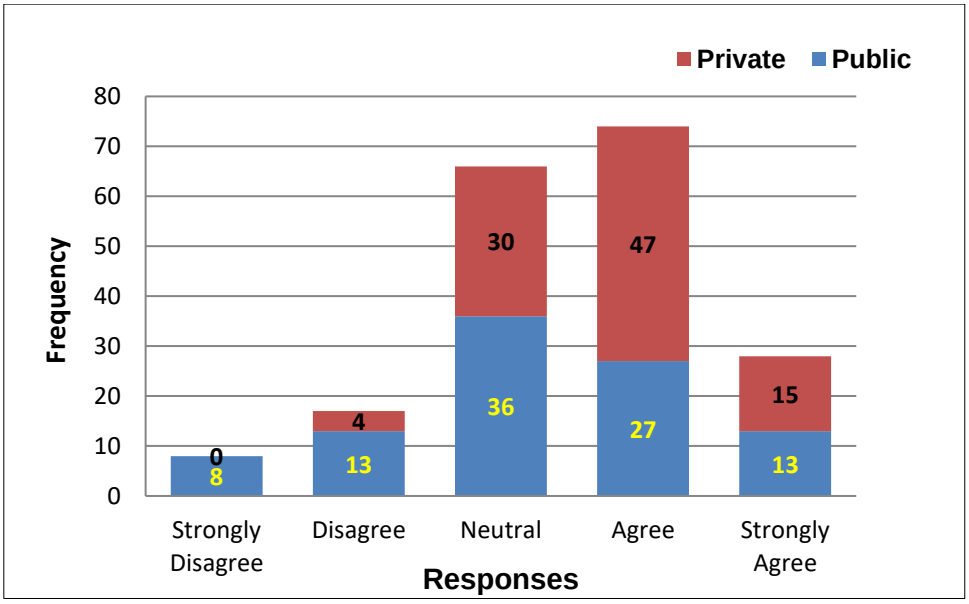


Figure B7: Is the temporary storage area sufficient

Referring to Figure B7 above, it is observed from the responses that more respondents in the private hospital than in the public hospital had a view that a temporary HCW storage area is sufficient (agree and strongly agree responses 47|104 (49%) and 15|104 (15.6%) in the private hospital and 27|106 (27.8%) and 13|106 (13.4%) in the public

hospital. A lot of respondents remained neutral on the subject matter. According to visits done by the researcher to both hospitals, the storage areas were observed as very small at the public hospital and HCW bags were found piled up on the storage room floor and some on the shelves. At the private hospital, the space was also small and there were no shelves to put HCW bags; there were some HCW bags which were seen lying on the floor. These results are similar to the findings by Debere et al (2013:27) who reported poor waste management practices.

Table B28: CHI-SQUARE TESTS FOR THE TEMPORARY STORAGE AREA

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.854[a]	4	.001
Likelihood Ratio	22.264	4	.000
Linear-by-Linear Association	13.089	1	.000
N of Valid Cases	193		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 3.98.

Chi-square tests (Table B28 above) shows that there is a statistical significant difference ($p < 0.05$) in relative response frequencies to whether the temporary HCW storage area is sufficient in the hospital or not. More responses from the private hospital seem to agree and strongly agree (62%) that the temporary HCW storage area is sufficient in the hospital and quite a number (30%) seemed to know nothing about this and very few disagreed (4%). More than two fifths of the responses from the public hospital agreed and strongly agreed (41.2%), whilst 37.1% were neutral and those that disagreed and strongly disagreed had responses at 13.4% and 8.2% respectively. According to this survey, this might mean that the temporary HCW storage area is sufficient for the private hospital but not as sufficient in the public hospital. The researcher did site visits and found the space not to be sufficient for the HCW since some bags were found piling on the floor in both hospitals (see pictures below). The city of Windhoek did its survey in 2015 and observed a similar situation of bags lying on the floor at the public hospital.

The pictures in plates 4.4a, 4.4b and 4.4c below depict the current situation which was observed at the public hospital's temporary storage room. The storage room is very small with very few shelves and it cannot accommodate all the HCW from the hospital. The hospital has two storage areas, one is meant for infectious waste which will be taken for incineration and the cage storage area is meant for general waste which is supposed to be taken to a landfill. Plate 4.4d and Plate 4.4e below show the HCW storage area for the private hospital.

Plate 4.4a: Public hospital's infectious HCW storage area

Plate 4.4b: Public hospital's healthcare storage area verandah

Plate 4.4c: Public cage storage area for general HCW

Plate 4.4d: Private hospital HCW storage area

Plate 4.4e: Private hospital HCW storage bags awaiting collection in front of the HCW storage room

Figure B8 below (pie charts) is a summary of the responses to whether the temporary storage area for HCW is lockable. For the private hospital, most responses indicated that the temporary HCW storage area is lockable 64|104 **(**64%) and for the public hospital, very few responses indicated that the storage room was lockable 31|106 (30.1%) and

most of the responses 40|106 (38.8%) show that people had no idea about whether the storage area is locked or not at the public hospital. On doing site observations, the researcher noticed that the healthcare storage room of the public hospital was kept unlocked all the time although the door was well labelled. There was nobody to receive and control the HCW brought to the storage room. The cleaners who brought the HCW bags just opened the door and placed the bags on the floor and closed the door and left. The researcher was told by the infection control officer that the lock was available at the infection control office and that it is very difficult to lock the place due to the HCW being brought in very often as the hospital has several departments. The infection control officer further stated that the police men and also a security guard are close to the area and so no attempt of stealing waste has been reported (Kastherody, A. 2016. Personal interview, 30 June. Windhoek). At the private hospital the HCW storage area was locked and keys were kept at the laundry department.

Further analysis using Pearson's Chi-square tests (Table B30, Appendix III) showed that there were statistically significant differences ($p < 0.05$) respectively between the public hospital and private hospital frequencies. It can be concluded, based on the Chi-square tests, that the temporary HCW storage facility is lockable at the private hospital but not so at the public hospital.

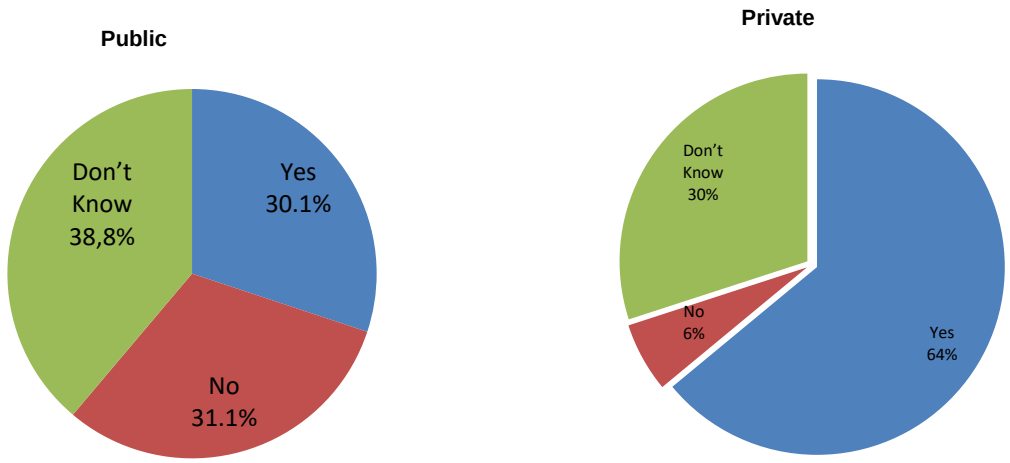


Figure B8: Is the temporary storage area for HCW lockable

According to Table B31 (Appendix III) and Table 4.2 above, most responses from the survey showed that both the public hospital 63|106 (75%) and the private hospital 55|104 (69.6%) temporarily store HCW for 24 hours before it is transported to the treatment facility. Very few responses of 17|106 (20.2%) and 21|104 (26.6%) representing the public

hospital and private hospital respectively indicated other time frames that the hospitals temporarily store HCW. It may be concluded that the most common time frame is 24 hours. The majority of healthcare workers in both hospitals possessed good knowledge on the storage times for hospital HCW. These findings tally with the study findings of a study by Abor (2013:375) who indicated that the respondents possessed good knowledge on HCW management practices.

Analysing the results of the responses (Table 4.2 above and Table B32, Appendix III) show that the majority of the respondents at the public hospital, 64|106 (62.1%) do not know; whereas more than a quarter 28|106 (27.2%) were negative and very few 11|106 (10.7%) were positive about HCW being weighed in the hospital. Responses from the private hospital were completely different from those of the public hospital, as more than half 53|104 (53%) of the responses were positive that HCW is weighed in the hospital and quite a number 41|104 (41%) of the responses indicated that they do not know about weighing of waste and a minority 6|104 (6%) were negative that HCW was weighed in the hospital. There were statistically significant differences ($p < 0.05$) in relative response frequencies between the two hospitals according to the Chi-square test statistics (Table B33, Appendix III). Based on these results we may conclude that HCW is weighed in the private hospital but not in the public hospital. The findings from the public hospital may indicate that the majority of the healthcare workers do not know what happens to the HCW when it leaves their departments as a large proportion of the sampled healthcare workers did not have a clue whether the HCW was weighed or not.

When the researcher did observation rounds at the public hospital, no scale was seen anyway in the departments or at the storage area. The infection control officer at the public hospital confirmed that the hospital did not have a scale for measuring HCW and they estimate the quantities of the HCW produced. These findings indicate that the public hospital did not weigh HCW as stipulated in the HCW policy in Namibia. The public hospital approximates the number of HCW bags produced per day. The bags are counted physically and not weighed. At the private hospital, there is a scale and waste was being measured according to the stipulated guidelines which are in the National waste policy. The findings from the public hospital tally with those by Debere et al (2013:27) who reported poor HCW practices and Bin and Hai (2014:2590) who reported poor practices by nurses, doctors and cleaners and the lack of proper equipment for the final disposal of HCW. The findings from the private hospital are similar to those from a study by Abor

(2013:375) who reported that the hospitals had a HCW management policy which they adhered to (see Plate 4.5 below).

Plate 4.5: Scale used to measure waste at the HCW storage area of the private hospital

4.2.2.3 HCW off-site transportation

Items 26 and 27 investigated HCW off-site transportation.

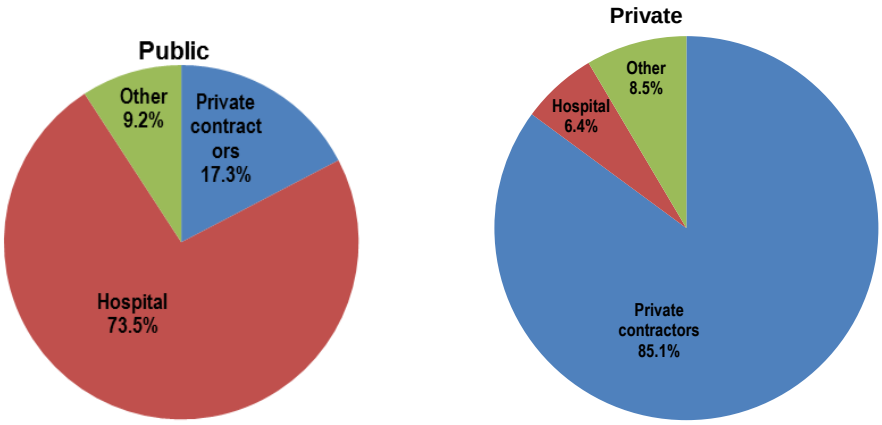


Figure B9: Who collects HCW to the treatment site?

From Figure B9 above, it is shown that 80|104 (85.1%) of the responses pointed out that at the private hospital HCW is collected by a private contractor's transport and 72|106

(73.5%) of the responses indicated that at the public hospital, HCW is collected by the hospital transport. Very few responses gave other modes of transport 9|106 (9.2%) for both the public hospital and 8|104 (8.5%) for the private hospital. Chi-square test statistics show that there were statistically significant ($p < 0.05$) differences in relative response frequencies between the two hospitals (Table B35, Appendix III). Both hospitals made use of properly stipulated waste vehicles for transporting their HCW to the treatment facility and landfill. These findings are not similar to the ones of Debere et al (2013:27) where the HCW handling practice was very poor and there was lack of proper equipment to transport HCW. The findings of Bin and Hai (2014:2592) also indicated lack of equipment for the final disposal of HCW.

Plate 4.6: Transport used by both hosptitals to carry general healthcare waste

Analysis of how often the HCW is collected to the treatment facilty (see Table B36, Appendix III) shows that 71|106 (78.9%) and 53|104 (63.9%) of HCW is collected daily from the public hospital and private hospital respectively to the treatment facility. Very few responses were for the other time period. No further analysis for these items was done because the Chi-square tests were not valid. This practice is in line with the national HCW directives of Namibia.

4.2.3 HCW management and training

In this section the training and management aspects related to the HCW management are presented in Table 4.3 below. Training in health and safety is needed for all healthcare workers in order for them to know how to effectively manage HCW including the use of

protective clothing. All healthcare workers are at risk of acquiring infection and hence they should receive adequate training (Pruss-Ustun et al 2014:140).

Based on this survey (refer to Table 4.3) in the private hospital, healthcare workers confirmed that they received training in HCW management but for the public hospital responses indicated that there was no training received. For both the private and public hospitals it was indicated that new employees are given training on HCW handling and management when they commence their duties. Most responses from the public hospital indicated that healthcare workers have no idea but most healthcare workers from the private hospital confirmed that HCW is being managed effectively. Most responses from the public hospital indicated that healthcare workers have no idea but healthcare workers from the private hospital however confirmed that HCW in the hospital is being handled according to the HCW policy of Namibia. Healthcare workers from both hospitals agreed that they were aware of documents outlining the HCW management policy at their hospital. The respondents indicated that at both the public and private hospitals, HCW management teams exist. The private hospital kept records of HCW generated and at the public hospital workers had no clue whether records are kept or not. It was also indicated in the responses from both hospitals that HCW are treated using incineration.

Table 4.3: HCW MANAGEMENT AND TRAINING

Characteristics		Public			Private		
		Frequency	Percentage (%)	Cumulative (%)	Frequency	Percentage (%)	Cumulative (%)
28. Training in HCW management?	Yes	47	34.3	34.3	74	71.3	71.3
	No	56	40.9	75.2	29	16.0	87.3
	Don't	3	2.2	77.4	10	5.5	92.8
	1 day	23	16.8	94.2	13	7.2	100.0
	< a week	0	0	0	0	0	100.0
	1 week	5	3.6	97.8	0	0	100.0
	> a week	3	2.2	100.0	0	0	100.0
29. Are new employees given training	Yes	40	40.8	40.8	73	72.3	72.3
	No	24	24.5	65.3	5	5.0	77.2
	Don't know	34	34.7	100.0	23	22.8	100.0
30. HCW is being managed effectively	Strongly Disagree	6	5.9	5.9	0	0	0
	Disagree	12	11.9	17.8	1	1.0	1.0
	Neutral	41	40.6	58.4	23	22.3	23.3
	Agree	28	27.7	86.1	59	57.3	80.6
	Strongly Agree	14	13.9	100.0	20	19.4	100.0
31. HCW policy of Namibia	Strongly Disagree	4	4.0	4.0	0	0	0
	Disagree	6	6.1	10.1	0	0	0
	Neutral	43	43.4	53.5	27	26.7	26.7
	Agree	29	29.3	82.8	53	52.5	79.2
	Strongly Agree	17	17.2	100.0	21	20.8	100.0
32. Waste management policy	Yes	54	53.5	53.5	66	63.5	63.5
	No	22	21.8	75.2	16	15.4	15.4
	Don't know	25	24.7	100.0	22	21.1	21.1
33. HCW management team?	Yes	61	59.8	59.8	78	75.0	75.0
	No	5	4.9	64.7	1	1.0	76.0
	Don't know	36	35.3	100.0	25	24.0	100.0
34. Hospital keep records of HCW generated?	Yes	36	35.6	35.6	58	55.8	55.8
	No	6	6.0	41.6	1	1.0	56.7
	Don't know	59	58.4	100.0	45	43.2	100.0
35. How is HCW treated?	incineration	94	90.4	90.4	87	88.8	88.8
	steam autoclaving	6	5.7	96.2	4	4.1	92.9
	microwaving	1	1.0	97.1	2	2.0	94.9
	other (specify)	3	2.9	100.0	5	5.1	100.0

From Table C1 (Appendix IV), responses from the private hospital show that the majority 74|104 (71.3%) received some training in HCW management and very few 13|104 (7.2%) further highlighted that the period of the training was one day. About 56|106 (40.9%) indicated that at the public hospital they did not receive any training. Whilst 47|106 (34.3%) said that they received training and that training was for one day. It is very clear that at the private hospital the majority of healthcare personnel received one day training but as for the public hospital quite a few might have received that training.

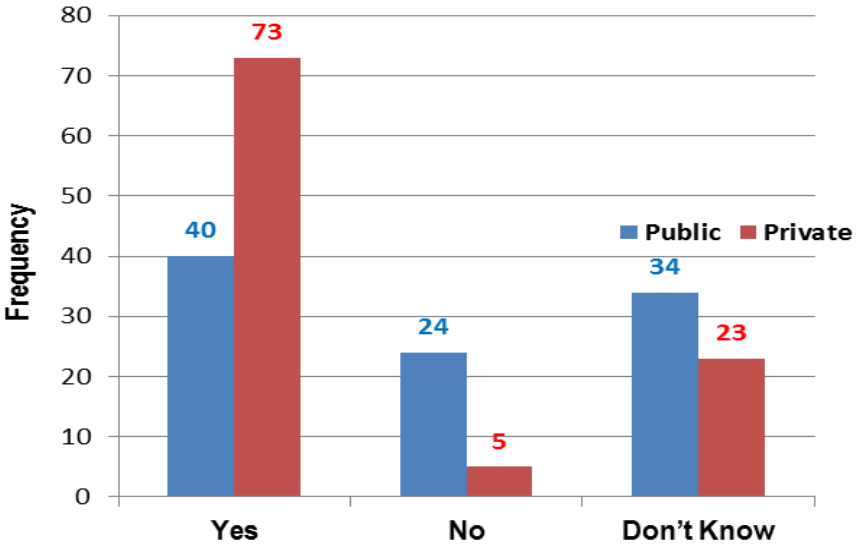


Figure C1: Are new employees given training on HCW management?

Chi-square tests assumptions were not valid for items 28 and 29 hence they were not performed. These findings may indicate that there is still a gap when it comes to HCW training in the hospital as less than half of the sampled healthcare workers reported receiving training. The researcher did a review of the records and found out that training records existed at the office of the infection control and the researcher had an opportunity to go through some of the test papers which employees wrote as part of training on HCW management at the public hospital. Both hospitals therefore train their employees on HCW management, which is not similar to a study done by Bin and Hai (2014:2590) where the findings indicated a lack of knowledge of respondents on HCW management, and also to a study conducted by Abah and Ohimain (2011:103) where responses to training were only 11.5%.

Figure C2 below and Table 4.3 from the private hospital showed that the majority 59|104 (57.3%) agreed and 20|104 (19.4%) strongly agreed that HCW is being managed

effectively and only 23|104 (22.3%) were neutral, 1|104 (1%) was negative about the management of HCW and no respondent strongly disagreed. For the public hospital, 12|106 (11.9%) disagreed, 6|106 (5.9%) strongly disagreed and 41|106 (40.6%) were neutral, 28|106 (27.7%) were on the agreeing side and 14|106 (13.9%) were on the strongly agree side.

Pearson's Chi-square tests (Table C4, Appendix IV) analysis shows that there were statistical significant difference ($p < 0.05$) in relative response frequencies of the public hospital and that of the private hospital. Since there is a significant difference, it may therefore mean that according to this survey HCW is being managed effectively at the private hospital than at the public hospital.

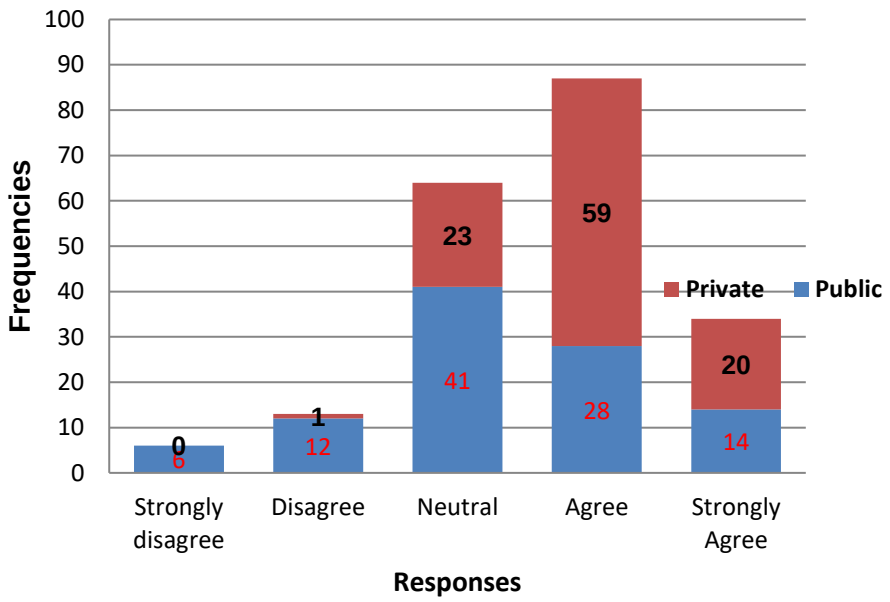


Figure C2: Is HCW being managed effectively?

From the results presented in Table C5, Appendix IV, responses show that quite a number, 43|106 (43.4%) for the public hospital and 27|104 (26.7%) for the private hospital were neutral about whether HCW is handled according to the HCW policy of Namibia or not in their respective hospitals. More than half agreed 53|104 (52.5%) and more than a fifth 21|104 (20.8%) strongly agreed that HCW is handled according to the HCW policy of Namibia at the private hospital. Less than a third agreed 29|106 (29.3%) and 17|106 (17.2%) strongly agreed that HCWs are handled according to the HCW policy of Namibia at the public Hospital. Very few at the public hospital disagreed 6|106 (6.1%) and strongly disagreed 4|106 (4%). At the private hospital none of the respondents disagreed on the

use of the HCW policy. The Chi-square test was not done because assumptions of Pearson's Chi-square test are not assertained. These findings might indicate that both hospitals are making use of the HCW policy of Namibia in handling their HCW. This is in contrast to a study by Castro et al (2014:864) whereby there was no HCW management plan or policy to follow. A study by Bin and Hai (2014:2590) also reported a lack of policy guidelines in HCW handling.

According to Figure C3 below and Table 4.3 above, responses from both hospitals indicate that the majority agreed 54|106 (53.5%) for the public hospital and 66|104 (63.5%) for the private hospital that they were aware of a document outlining the HCW management policy at their hospital. More than a fifth 22|106 (21.8%) for the public hospital and 16|104(15.4%) for the private hospital indicated that there was no document outlining the HCW management policy at their hospital. Almost a quarter 25|106 (24.7%) of the respondents from the public hospital and more than a fifth 22|104 (21.1%) from the private hospital did not know about this document. Chi-square analysis show that there were no statistical significant differences ($p > 0.05$) in relative frequencies of responses to the knowledge of any document outlining the HCW management policy at their hospital. In view of these findings, it looks like some of the sampled healthcare workers were not sure of the presence of the HCW policy, which is not a good indication.

The researcher did a review of the HCW records and departmental observations and found that the HCW policy existed at the hospital. The majority of respondents were aware of the existence of a HCW policy and they responded positively. They were also aware of the presence of a hospital HCW management team. These findings indicate that the respondents possess good knowledge on the HCW management practices and this is supported by the study findings of Abor (2013:375) who indicated that respondents from both the public and private hospitals had a HCW management policy, had HCW management plans and HCW management teams.

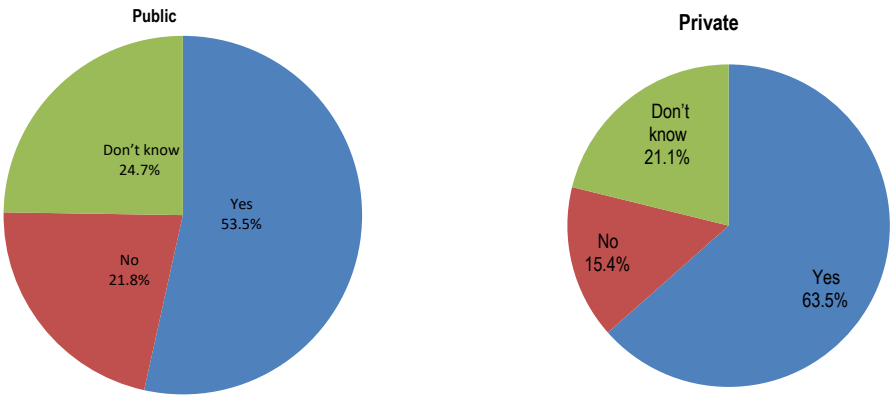


Figure C3: Any document outlining the HCW management policy?

Table 4.3 above illustrates that the majority of responses 61|106 (59.8%) for the public hospital and 78|104 (75%) for the private hospital indicated the presence of a HCW management team at their hospitals. More than a third, 36|106 (35.3%) of the respondents from the public hospital and almost a quarter 25|104 (24%) of the respondents from the private hospital pointed out that they did not know about the HCW management policy and very few 5|104 (4.9%) of the respondents from the public hospital and 1|104 (1%) from the private hospital reported that there was no HCW management team at their hospitals. It can be concluded that in both hospitals, the general perception is that there is a HCW management system based on this survey. This is in contrast with study findings by Saat et al (2013:73) who reported a lack of a good HCW management team and lack of clear legal policy frameworks for HCW management.

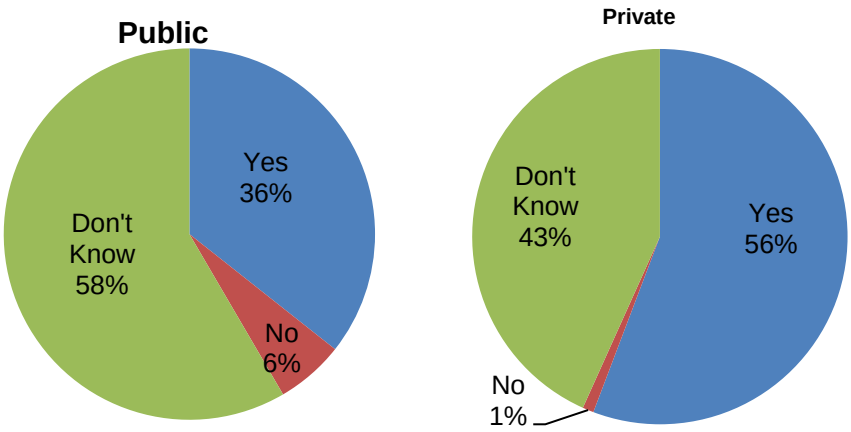


Figure C4: Existence of records of HCW generated

Figure C4 above shows a summary of the responses from the survey where the researcher was assessing the existence of records of HCW generated in the two hospitals. Results of the survey show that more than half 58|104 (55.8%) of the responses pointed out that records of HCW do exist and more than two thirds 45|104 (43.2%) of the responses did not know about the existence of HCW records at the private hospital. More than half of the healthcare workers 59|106 (58.4%) from the public hospital did not know whether HCW records existed at their hospital or not. More than a third of responses 36|106 (35.6%) agreed that there exist HCW records. It can therefore be concluded that according to this survey at the private hospital, there exist HCW records whereas at the public hospital many people seem not to know about this. According to the researcher's site visits at the public hospital, it was noted that the infection control officer has got some records although they are based on estimated quantities of the HCW generated in the hospital. The healthcare workers at the public hospital count bags and record the total number of bags generated per day and per month. At the private hospital, the healthcare workers weigh the HCW and record the total number of HCW in kilograms. However the majority of respondents were not sure whether records were kept or not, which somehow indicates some lack of knowledge on the part of HCW management.

From Table C10 in Appendix IV, the majority of respondents (90.4%) from the public hospital and (88.8%) from the private hospital indicated that the method of treating HCW is by incineration (See Table 4.3 above). Very few responses pointed out other HCW treatments like steam autoclaving 6|106 (5.8%) of the respondents from the public hospital and 4|104 (4.1%) of the respondents from the private hospital. About 1|106 (1%) of the respondents from the public hospital and 2|104 (2%) of the respondents from the private hospital chose microwaving. About 3|106 (2.9%) of respondents from the public hospital and 5|104 (5.1%) of respondents from the private hospital indicated other treatment options. The most prevalently used method for treating HCW is incineration. Chi-square test could not be used to compare response frequencies of the two hospitals for items 33, 34 and 35 because assumptions of this statistical test are not assertained. Incineration is the main treatment method for both hospitals and it is as per set guidelines which are in the national waste policy. This is similar to a study by Debere et al (2013:20) where the findings also indicated the use of incinerators. In another study by Bin and Hai (2014:2592), the findings were not similar as they lacked a lot of equipment including incinerators. The findings are also similar to a study by Ghasemi and Yusuff (2016:22) where incineration was used as the preferred choice for HCW treatment.

4.2.4 Impact of HCW

HCW poses a great risk to HCW handlers, the healthcare workers, patients and the community if it is not managed and disposed of in a proper and safe way (Akum 2014:27). According to WHO (2005:3) HCW can have a direct impact on both the public and the environment. Human health can be greatly affected through the use of contaminated water bodies and breathing polluted air. Air pollution can occur as a result of HCW being burned in the open or in incinerators which lack emission controls. Water bodies can be contaminated when HCW is disposed of in pits which are not lined and are very close to the water bodies. In this section, the results on the assessment conducted on impacts of health are presented in Table 4.4 below.

From the responses (refer to Table 4.4) below, sharps injury was indicated as risks of HCW to human health for both hospitals and air pollution was commonly pointed out as risk of HCW to the environment.

Table 4.4: IMPACTS OF HCW

Characteristics		Public			Private		
		Frequency	Percentage (%)	Cumulative (%)	Frequency	Percentage (%)	Cumulative (%)
36. Risks of HCW to human health?	Sharps	93	37.7	37.6	92	40.5	40.5
	Hepatitis	81	32.8	70.4	73	32.2	72.7
	HIV	70	28.3	98.8	57	25.1	97.8
	Other	3	1.2	37.7	5	2.2	100.0
37. Risks of HCW to the environment?	Air pollution	86	56.2	56.2	90	57.0	57.0
	Ground water pollution	57	37.3	93.5	64	40.5	97.5

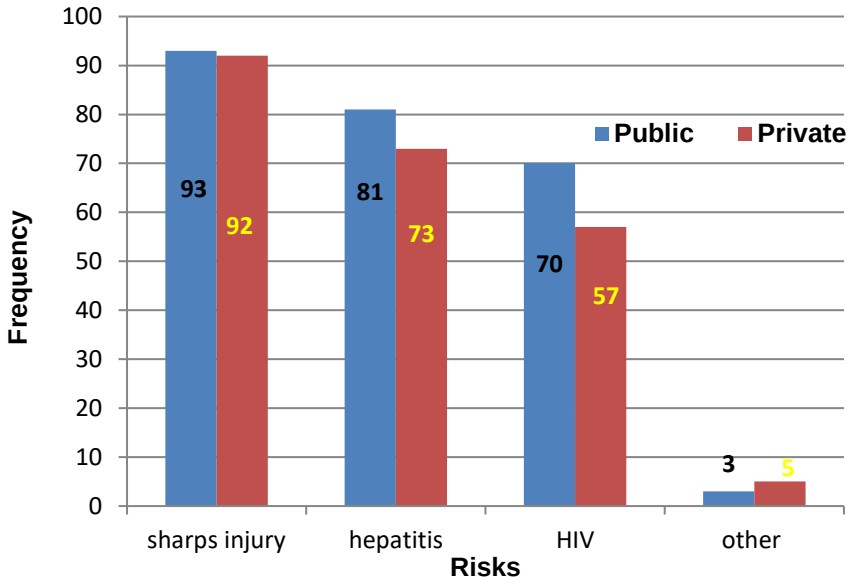


Figure D1: Risks of HCW to human health

From the results presented in Figure D1 above, it is clear that the majority of the respondents were knowledgeable about the health risks occurring in the hospital due to HCW. The majority of respondents in both the public hospital and private hospital indicated that health risks which are more likely to occur in the hospital include sharp injury, hepatitis and HIV. However the percentages for the respondents from the private hospital were slightly lower than those from the public sector in all the mentioned health risks as depicted in the figure above.

Responses from (Figure D1) above show that for the public hospital less than two fifths (37.7%) of the respondents and 40.5% respondents from the private hospital pointed out sharps injury. Almost a third (32.8%) of the respondents from the public hospital and 32.2% of the respondents from the private hospital indicated hepatitis and more than a quarter (28.3%) of the respondents from the public hospital and a quarter (25.1%) of the respondents from the private hospital pointed out HIV and very few (1.2%) of the respondents from the public hospital and 2.2% of the respondents from the private hospital indicated “others” as the human healthcare risks. Therefore the most common human healthcare risk based on this survey is sharps injury as attested to by both hospitals (see Plates 4.7 and 4.8 below). This study is similar to a study by Manyele and Lyasenga (2010:106) who reported that many injuries occur due to sharps which are not collected in their right receptacles and that at the landfill sites scavengers can come in contact with HCW which was not disposed of properly and thus sustain sharps injury.

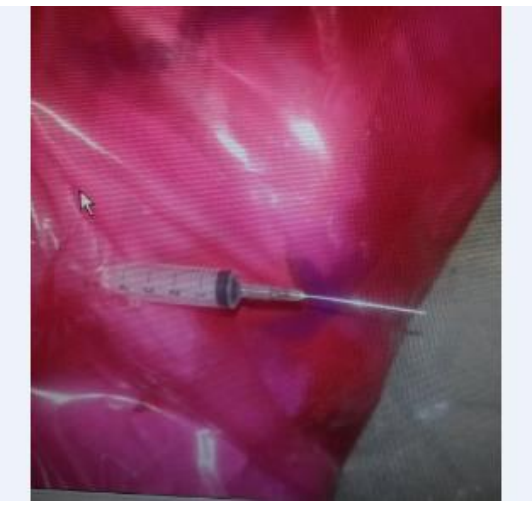


Plate 4.7: Syringe and needle sticking out of a red infectious plastic bag

Plate 4.8: Incinerator ash residue which contains sharps objects capable of causing sharps injury

According to Table 4.4 above, it shows that for the public hospital more than half (56.2%) of the responses and 57% of the responses from the private hospital pointed out air pollution; whilst more than a third (37.3%) of responses from the public hospital and more than two fifths (40.5%) of responses from the private hospital indicated ground water pollution. So the most common risk of HCW to the environment according to the responses from both hospitals is air pollution. Chi-square analysis show that there were no statistical significant differences ($p > 0.05$) in relative frequencies of responses to possible human risks and environmental risks of HCW in the two hospitals. A study done by Abah and Ohimain (2011:102) indicated that the treatment choice was burning and burying of HCW hence exposing the public and environment to air pollution and ground water pollution (see Plates 4.9a above and 4.9b below).

Plate 4.9a: Incinerator at Hospital A

Plate 4.9b: A cloud of black smoke from the Public hospital incinerator which can cause air pollution

4.3 CONCLUSION

In this chapter the results were presented and findings were explained. The results were presented under the following headings; sample demographics, HCW management practice, HCW management and training and impact of HCW. This chapter leads the reader to the last chapter of the research.

CHAPTER 5

CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

5.1 INTRODUCTION

The purpose of the current study was to investigate the HCW management practices at a public and private hospital in Khomas region, Namibia and consequently to develop recommendations related to HCW management in the country. This chapter provides the summary of the study and interpretation of the findings. Recommendations drawn from the findings of the study are presented in this chapter for the purposes of clinical practice and for further research. Contributions of the study are outlined and the study limitations are specified.

It is important to recall the objectives of the study in order to relate them to the findings that emerged in this research. The objectives of the current study were to:

- Determine the level of knowledge and awareness of healthcare workers regarding HCW management at a public hospital and private hospital.
- Assess and compare HCW management practices at a public hospital and private hospital.
- Determine the extent to which the selected healthcare facilities, public and private Hospitals are complying with the HCW policy of Namibia.

5.2 SUMMARY AND INTERPRETATION OF MAJOR FINDINGS

The study focused on the investigation of HCW management at two hospitals in Khomas region, Namibia. The hospitals were one public hospital and one private hospital. The summaries of major findings are presented as follows:

5.2.1 Public hospital

- The hospital has two HCW storage areas, the in-house storage area for infectious HCW (red bags) and a cage storage area at the back of the hospital which is meant for general HCW.
- The storage area for infectious HCW is very small as compared to the volume of HCW bags received from the whole hospital per day. The storage room could not accommodate all the bags and most of the bags were seen piled up on the floor. The few shelves in the store room can only accommodate a few HCW bags.
- The HCW storage area is not lockable and there is no form of control over the HCW which is brought to the store room, as there is no personnel to receive the HCW and the HCW is just placed anyhow in the storage room; as a result it is difficult to track the source of the HCW, that is from which department the HCW was generated.
- There is no scale to quantify HCW, the HCW should be labelled with a sticker indicating the source of origin and should be weighed and kilograms noted to enable the management to be able to plan for the management of such waste.
- The cage storage area is not ideal as it gets affected by variations in weather conditions for example rain. Rodents also get access to the HCW bags as well.

5.2.2 Private hospital

- The HCW storage area in the private hospital is not sufficient. There are no shelves and as a result, HCW bags are placed directly on the floor.
- There is a scale available for measuring HCW bags and a HCW register to enter the quantities of HCW brought to the storage room.
- The storage area is kept locked at all times and the keys are kept in the laundry department of the hospital.

5.3 CONCLUSION AND RECOMMENDATIONS

The conclusions based on the findings of the study are:

i. The respondents in both hospitals showed good knowledge on the following:

- types of HCW generated in their departments
- segregation of HCW
- colour coding system
- use of protective clothing when handling HCW
- Mode of transport used both for onsite and offsite transportation of HCW
- Impacts of HCW to human health and the environment

ii. However, in both the public and private hospitals, the respondents did not possess enough knowledge on the following aspects:

- HCW temporary storage area
- Weighing of HCW
- Existence of HCW policy
- Existence of a HCW management team
- Availability of records of HCW generated
- Treatment of HCW

iii. Private hospital respondents possessed better knowledge of HCW management aspects than public hospital respondents.

iv. HCW management practice

- The observations done in both hospitals revealed that the segregation of HCW was being done in the hospitals although it was carried out in varying degrees by healthcare workers as mixing of different HCW was still occurring.
- There was good evidence of the existence of a colour coding system in both hospitals as bins were lined with different colour coded bags for different types of HCW.

- Use of protective personnel equipment during handling of HCW was also noted. Gloves and aprons were mainly used in both hospitals
- Instructive posters on HCW segregation were available in all the departments in both hospitals to help inform the healthcare workers on how to segregate the HCW
- Both hospitals used wheeled trollies for on-site transportation of HCW to the temporary storage area
- Both hospitals had a temporary storage area although the storage room space was inadequate
- The public hospital made use of hospital transport for the transportation of HCW to the treatment facility (incinerator). The hospital transport does not have a spill kit to manage spillages
- The private hospital made use of a private contractor to transport its HCW to the treatment facility at the public hospital.
- The private hospital does not have its own treatment facility; the private contractor collects HCW daily in the morning and transports it for incineration at the public hospital treatment facility.
- The private contractor's transport met the specified rules on HCW transportation according to the HCW Risk Management Directives of Namibia. A spill kit was readily available and the driver carried a HCW manifesto document which is filled out in triplicate by the private hospital stating the quantities of HCW given to the driver to take to the treatment facility. On arrival at the treatment facility, the manifesto document is given to the incinerator operators who acknowledge having received the quantities of HCW written on the manifesto. The private contractor company then takes a copy back to the private hospital as proof of delivering all the HCW which was assigned to them. This practice enables HCW to be tracked easily. The public hospital does not have any waste tracking system in place. HCW is collected and delivered at the incineration site and only the number of HCW bags sent for incineration are noted and recorded, the actual quantity of HCW collected is not written in kilograms as both the public hospital and the treatment facility have no scale for weighing HCW.

- Both hospitals make use of the treatment facility at the public hospital. This treatment facility is the one catering for all the hospitals and primary healthcare centres in Khomas region. The treatment facility houses three incinerators. The personnel handling HCW at the incinerators wore adequate protective clothing which is a very good practice (see Plate 5.1, Appendix V). The treatment facility has adequate cold storage rooms with enough shelves to store HCW before it is incinerated (see Plates 5.2a and 5.2b, Appendix V).
- There was no scale seen anywhere in the treatment facility. The numbers of bags are recorded and the treatment facility charges the cost of treating HCW per bag and not according to the weight of the HCW bags. The incineration workers do no account for the number of bags fed into the incinerator chambers at a given time; they do manual feeding of HCW bags and they have to periodically mix the burning HCW with long sticks (see Plate 5.3, Appendix V). There is always a cloud of black smoke that is produced by the incinerators as a result of the manual feeding and constant opening of the incinerator chambers which can cause incomplete combustion. This black smoke causes air pollution and is not good for human health. There is also a great chance that the incinerators are being overloaded since the quantities of HCW are estimated and not known as there is no scale to check the actual weight of the HCW bags.
- The ashes from the incinerators are collected and sent to Kupferberg landfill site for final disposal (burying). The ash contains sharps residues which can cause injury and transmit diseases if not handled properly (see Plate 5.4, Appendix V). The ashes are then buried on the specific site meant for hazardous HCW (see Plates 5.6a and 5.6b, Appendix V).
- The landfill site is situated very far from the community and it is well fenced and is under 24 hour camera surveillance. On arrival at the entrance, there is a weighbridge, whereby both the vehicle mass and HCW mass are weighed. The vehicle is then weighed again on the exit point after offloading the HCW to get the actual quantity of HCW in kilograms by subtracting the mass of the empty vehicle from the mass of the vehicle with HCW (see Plate 5.5, Appendix V).

- The landfill site area cannot be accessed without prior permission from the respective authority (City of Windhoek). There were no scavengers seen on

site. The researcher had a chance to have a tour of the entire site and was satisfied with the set up and practice as it was up to standard and according to the stipulated specifications.

The findings of the current study are similar to the findings of a study conducted by Das and Biswas (2016:23) which concluded that good use of personal protective equipment by healthcare workers was essential in HCW management. The research found that the healthcare workers possessed good knowledge on the harmful effects of HCW. However the same study was in contrast with this study finding on the issue of HCW segregation. There was no HCW segregation practised despite the availability of a colour coding system (Das & Biswas 2016:24).

The findings of a study done in Nigeria by Longe (2012:564) was in contrast to the current study findings. Longe's (2012:564) study revealed a lack of a management plan and policy. In Longe's (2012:564) study it was revealed that there were no HCW training conducted and no adequate provision of personal protective equipment for handling HCW. The HCW was burned and buried within the hospital premises. The landfill site lacked adequate designing and incidences of gross underground water contamination were reported. However, one similarity with previous study findings and the current study emerges. The similarity is that both results, previous and present concluded that studied hospitals did not have proper storage areas for HCW at their facilities.

Another contrast was identified in a study by Sartaj and Arabgol (2014:105) whereby hazardous HCW was disposed together with the general waste at the same landfill trenches without prior treatment of the HCW. Thus, the findings of the current study remain indispensable in the management of HCW in hospitals, particularly in Namibia.

5.4 RECOMMENDATIONS

The current HCW management practices at the public hospital and private hospital were assessed and some areas of non-compliance with the existing country's policy on HCW were identified. According to the findings which emerged from this study, there is a need to improve on the current HCW management practices in the local context. In order to

achieve this, some recommendations are presented below for different aspects of the HCW management.

Based on the findings of the study, the following are recommended:

i. Knowledge

- Continuous training of HCW management staff needs to be organized in order to achieve better results, which are the implementation of quality management systems.
- Training courses on HCW management should be developed and presented periodically to healthcare workers to help achieve improved information systems which will contribute to a better HCW management system in the interest of long term sustainable HCW management.
- All healthcare workers are to receive training regardless of profession and position; the training should not be limited to cleaners and nurses only in the hospital but, periodic training should be done to all healthcare workers at all levels. This will enhance a more informed workforce and raise awareness on issues related to HCW management issues. Training will also help to sensitise healthcare workers and help them to become advocates for best practice and help to improve and sustain a good HCW management system.

ii. HCW management and practice

- Regular meetings should be done on HCW management issues in order to identify gaps in the current HCW practices and develop ways to improve on the HCW management practice. Feedback on HCW management should be given in order to improve management which can contribute to the appropriate costing and financial management of HCW.
- Continuous supervision and monitoring mechanisms should be developed for the effective implementation of HCW management in the hospital.
- The healthcare facility management should employ more dedicated staff to work hand in hand with the infection control officer in order to help with training, monitoring and evaluation of HCW management issues.

- The management should look into building proper and adequate storage facilities to cater for the amount of HCW produced in the hospital.
- Purchasing of a scale to quantify HCW in order to take note of quantities of HCW produced which helps in planning for the proper management of the HCW based on actual HCW generation rates.
- A move from use of incinerators to the use of non-burn waste technology to improve emission standards is already in progress. There is a new HCW treatment facility which is expected to be functional by the end of June 2017 (see Plate 5.7, Appendix V). This treatment facility is owned by the City of Windhoek and it will house an incinerator and an autoclave. All the infectious waste like bandages will go through non-burn technology and it will be sterilised first in the autoclave and shredded before being taken to the landfill site for final disposal. It is further recommended that pathological waste like human limbs and placentas be incinerated first before final disposal. It is highly recommended that all healthcare workers at all levels be trained on the use of the new HCW treatment facility.

iii. HCW policy

- Efforts should be made to reinforce and implement the current Healthcare Risk Waste Management Directives and National Waste Policy of Namibia through intensive advocacy in outreach programs.
- Strict monitoring and risk based inspection system to ensure compliance with the existing regulations should be enforced.
- Policies are to be made known to all healthcare workers through continuous training to ensure that the healthcare workers are up to date with current knowledge and practices.
- Periodical review and amendment of the policy is also needed so as to keep pace with the changing environment in HCW management in the country and elsewhere.

5.5 FUTURE RESEARCH

- Research is a continuous process. The current research recommends that further research should be undertaken to determine other variables not covered in the scope of this study but are relevant and contribute to the achievement of the objectives that enhance HCW management.
- A similar evidence based research study can be carried out at a different setting at regional and national levels and the study findings can be compared to this study's findings. The research can include other private hospitals, clinics and primary healthcare centres.
- A more informed research that utilizes a mixed methods research design is recommended for future similar studies in order to find out the perceptions of healthcare workers on issues of HCW management.
- The role of stakeholders in the safe disposal of HCW can be looked into.

5.6 CONTRIBUTIONS OF THE STUDY

- The study findings can help the healthcare workers to be fully informed about the current practice and help increase awareness and ensure effective management of HCW.
- Policy makers can utilise the study findings in improving their existing policies in order to promote good HCW management.
- The literature or the gaps presented in the literature in the current study lay a foundation for future research in the same area.
- The study findings may help the Ministry of Health in Namibia to address the identified gaps and strengthen the proper management of HCW.

5.7 LIMITATIONS

The availability of historical studies on HCW management indicates that there is inconsistency in the manner in which HCW is managed and disposed. Therefore the findings of the research may not be generalizable to the entire healthcare sector in Namibia.

There is little research available on HCW management in Namibia. Thus, the review of literature was heavily dependent on the studies carried out in other developing and

developed countries. During the course of this study, there was an inconsistence of the respondents' availability due to work shifts. This resulted in potential respondents missing on chances of participating in the current study. The sample size was therefore not large enough to yield statistically significant differences expected in the current study.

The researcher faced a challenge with the category of doctors; they agreed to participate in the study but they were impatient with completing the questionnaires. Most of them reported that they were always busy and did not have time to complete the questionnaires. Some gave remarks that the HCW management was not part of their job description and they were never taught anything to do with HCW at medical school and they did not see the reasons why they should partake in the survey.

Another limitation was the short duration of the study and lack of availability of time from the researcher's side as the researcher has a full time job. Ethical constraints were also a possible limitation as the study necessitated observing respondents in their working areas without notifying them of the researcher's presence in order to avoid reactive effects from respondents.

It is important to conclude the current discourse on the limitations of the study by citing Simon and Goes (2013:20) who concluded that regardless of how well a research study is conducted as well as constructed, it will have limitations.

5.8 CONCLUSION

In this chapter, discussions of the main results were presented and final conclusions reached. The research findings highlighted the lack of understanding and the skills of HCW management by the healthcare workers involved in the process. Lack of knowledge of the processes of HCW disposal, a lack of adequate storage facilities, lack of quantification tools and lack of training of healthcare workers resulted in this research. Relevant recommendations inherent to this study were made.

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APPENDICES

APPENDIX I

Table 4.01: DATA CODING

Item	Sub-item	Code
Item 1	Public hospital	1
	Private Hospital	2
Item 2	female	1
	male	2
Item 3	21-30	1
	31-40	2
	41-50	3
	51-60	4
	over 60	5
Item 4	Less than 1 year	1
	1-5 years	2
	More than 5 years	3
Item 5	Emergency Centre (casualty)	1
	Intensive care unit(ICU)	2
	Kitchen	3
	Maternity Ward	4
	Medical Ward	5
	Paediatric Ward	6
	Pharmacy	7
	Laundry	8
	Theatre	9
	Surgical	10
Item 6	Registered Nurse	1
	Enrolled Nurse	2
	Enrolled Nurse Assistant	3
	Doctor	4
	Pharmacist	5
	Cleaner	7
	Pharmacist assistant	10
Item 7	Infectious waste for example blood, body fluids	1
	Anatomical waste for example human tissue, body parts, foetus	2
	Sharps waste for example needles, scalpels, blades, broken glass	3
	Pharmaceutical waste for example outdated medications, vaccines, contaminated pharmaceutical products	4
	Chemical waste for example reagents , solvents	5
	General waste for example paper, plastics, bottles, cartons	6
	Radioactive waste for example solid , liquid and gaseous waste contaminated with radionuclides other (specify)	7
Items 8, 16 & 17	Strongly disagree	1
	Disagree	2
	Neutral	3
	Agree	4
	Strongly agree	5

Item	Sub-item	Code
Item 9	Nurses	1
	Doctors	2
	Pharmacists	3
	Pharmacist assistants	4
	Cleaners	5
	Kitchen staff	6
	laundry staff	7
	Porters	8
	other (specify	9
Item 10, Item 11, Item 23, Item 25, Item 29, Item 32, Item 33, Item 34	Yes	1
	No	2
	Don't know	3
Item 12, Item 13, Item 14, Item 15	red plastic bag	1
	yellow plastic bag	2
	brown plastic bag	3
	black plastic bag	4
	other (specify)	5
Item 18	Gloves	1
	Aprons	2
	Face masks	3
	Goggles	4
	Gum boots	5
	other (specify	6
Item 19	wheelie bins	1
	wheeled trollies	2
	Carts	3
	other (specify)	4
Item 20	once a day	1
	twice per day	2
	per rising need	3
	other (specify)	4
Item 21	Nurses	1
	Doctors	2
	Pharmacists	3
	Pharmacist assistants	4
	Cleaners	5
	Kitchen staff	6
	laundry staff	7
	Porters	8
	other (specify)	9
Item 24	24 hours	1
	48 hours	2
	72 hours	3
	other (specify	4
	24 hours	5
Item 26	Private contractors transport	1
	Hospital transport	2
	other (specify)	3
Item 27	Daily	1
	Once a week	2
	Once per fortnight	3
	Once a month	4

Item	Sub-item	Code
	other (specify)	5
Item 28	Yes	1
	no	2
	Don't know	3
	One day	4
	Less than a week	5
	One week	6
	More than a week	7
Item 35	incineration	1
	steam autoclaving	2
	microwaving	3
	other (specify)	4
	incineration	5
Item 36	sharps injury	1
	hepatitis	2
	HIV	3
	other (specify)	4
Item 37	air pollution	1
	ground water pollution	2
	other (specify)	3

Table 4.02: PEARSON’S PRODUCT MOMENT CORRELATIONS

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.02

Correlations

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q13	Q14	Q15	Q16	Q17	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Total
Q1	Pearson Correlation	1	.139	.185	.108	.213	-.019	-.149	.267	.090	.244	.312	.107	.154	.213	.241	.060	-.192	.058	.116	.403*	-.019	.204	-.085	-.531**	.488*	.122	-.038	.373*	.224	-.068	.090	-.010	-.143	.089	-.127	.491**
	Sig. (2-tailed)		.465	.327	.571	.260	.922	.431	.162	.642	.194	.093	.573	.461	.268	.199	.754	.338	.779	.555	.030	.922	.375	.653	.005	.011	.527	.844	.046	.244	.727	.642	.960	.466	.647	.503	.006
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q2	Pearson Correlation	.139	1	-.013	.023	-.030	.188	-.068	.039	-.148	-.141	.515**	-.279	-.401*	.213	.106	-.052	-.214	.162	-.034	-.318	.373*	.571**	.163	.427*	.330	.645**	.278	-.108	-.310	.073	.244	.419*	-.155	.068	.025	.442
	Sig. (2-tailed)	.465		.945	.905	.874	.320	.722	.840	.445	.456	.004	.136	.047	.268	.577	.784	.285	.428	.863	.093	.046	.007	.390	.029	.099	.000	.144	.578	.101	.708	.203	.024	.432	.727	.894	.051
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q3	Pearson Correlation	.185	-.013	1	.611**	-.144	-.188	-.300	.133	-.222	.142	.394*	-.237	.244	.063	.106	.113	-.355	-.071	.259	.202	-.057	-.063	.107	.093	.026	.046	.282	.163	.268	.245	.010	-.085	.319	-.325	-.141	-.001
	Sig. (2-tailed)	.327	.945		.000	.447	.321	.107	.493	.248	.454	.031	.207	.239	.745	.577	.551	.069	.729	.184	.294	.770	.785	.574	.652	.900	.812	.138	.399	.160	.200	.960	.659	.098	.085	.459	.996
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q4	Pearson Correlation	.108	.023	.611**	1	-.118	-.418*	-.281	.202	-.380*	-.243	.329	.025	.151	.352	-.021	-.216	-.391*	-.078	.212	.227	.282	-.247	.160	-.123	.078	.253	.244	-.024	-.094	.146	.124	.243	.209	-.035	.241	-.056
	Sig. (2-tailed)	.571	.905	.000		.533	.022	.132	.292	.042	.195	.076	.894	.470	.061	.911	.251	.044	.705	.279	.236	.138	.280	.398	.548	.705	.186	.201	.900	.627	.450	.521	.205	.286	.857	.200	.771
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q5	Pearson Correlation	.213	-.030	-.144	-.118	1	-.023	-.102	-.171	.036	.176	-.161	.023	-.222	.385*	-.029	-.123	-.100	.164	-.131	.191	-.003	.346	.072	-.032	.159	.140	.362	.198	-.169	-.317	-.147	.314	-.260	-.043	-.191	.270
	Sig. (2-tailed)	.260	.874	.447	.533		.906	.591	.374	.852	.353	.397	.904	.287	.039	.880	.518	.621	.423	.506	.321	.990	.124	.707	.877	.439	.470	.053	.303	.381	.094	.445	.097	.182	.826	.311	.150
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q6	Pearson Correlation	-.019	.188	-.188	-.418*	-.023	1	.371*	.054	.119	.319	.173	-.071	-.121	-.128	.303	.003	.201	.039	-.233	.114	.033	.016	-.079	.264	.122	.213	.210	-.172	-.187	.258	.219	-.058	-.149	-.161	-.214	.539**
	Sig. (2-tailed)	.922	.320	.321	.022	.906		.044	.781	.539	.085	.361	.711	.566	.510	.104	.987	.314	.852	.232	.556	.864	.946	.679	.193	.552	.268	.275	.373	.332	.177	.253	.764	.450	.403	.256	.002
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q7	Pearson Correlation	-.149	-.068	-.300	-.281	-.102	.371*	1	-.236	.452**	.182	-.308	-.195	.246	-.356	.313	.085	.320	.029	-.299	-.111	-.116	-.110	-.321	.016	-.055	.176	-.061	-.239	-.085	.246	.182	-.079	.105	.606**	-.005	-.501**
	Sig. (2-tailed)	.431	.722	.107	.132	.591	.044		.217	.003	.336	.098	.303	.226	.058	.092	.657	.091	.889	.109	.568	.547	.636	.084	.939	.791	.312	.752	.213	.661	.198	.345	.684	.596	.000	.976	.000
	N	30	30	30	30	30	30	52	29	42	30	30	30	26	29	30	30	29	26	30	29	29	21	30	26	26	35	29	29	29	29	29	29	28	46	37	52
Q8	Pearson Correlation	.267	.039	.133	.202	-.171	.054	-.236	1	-.048	-.376*	.059	-.047	.277	.173	.149	-.096	-.062	-.103	.088	.289	-.103	.194	-.021	-.154	.140	-.188	-.309	.259	.244	-.218	-.057	-.206	.244	.053	.135	.423*
	Sig. (2-tailed)	.162	.840	.493	.292	.374	.781	.217		.806	.045	.762	.811	.189	.378	.440	.620	.762	.623	.661	.135	.601	.413	.914	.462	.504	.337	.109	.183	.211	.266	.772	.294	.210	.787	.484	.027
	N	29	29	29	29	29	29	29	29	29	29	29	29	24	28	29	29	26	25	27	28	28	20	29	25	25	28	28	28	28	28	28	28	28	28	29	29
Q9	Pearson Correlation	.090	-.148	-.222	-.380*	.036	.119	.452**	-.048	1	.180	-.288	.016	-.003	-.497**	.229	.352	.434*	.108	.038	.176	-.396*	.212	-.119	-.220	-.198	-.210	-.307	.406*	.364	-.224	.125	-.376*	-.136	.304	-.084	-.167
	Sig. (2-tailed)	.642	.445	.248	.042	.852	.539	.003	.806		.350	.129	.933	.990	.007	.232	.061	.024	.608	.843	.369	.037	.369	.540	.291	.342	.249	.112	.032	.057	.251	.527	.048	.491	.053	.636	.285
	N	29	29	29	29	29	29	42	29	43	29	29	29	25	28	29	29	27	25	30	28	28	20	29	25	25	32	28	28	28	28	28	28	28	41	34	43
Q10	Pearson Correlation	.244	-.141	.142	-.243	.176	.319	.182	-.376*	.180	1	-.073	.058	.194	.051	.406*	.260	.047	.091	.030	.324	-.194	-.158	-.304	-.205	-.091	-.136	.239	.265	.294	.051	-.127	-.210	-.037	-.051	-.068	0.391*
	Sig. (2-tailed)	.194	.456	.454	.195	.353	.085	.336	.045	.350		.702	.762	.354	.791	.026	.165	.816	.659	.879	.087	.313	.494	.103	.315	.659	.480	.211	.166	.122	.791	.512	.275	.852	.791	.720	.051
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q11	Pearson Correlation	.312	.515**	.394*	.329	-.161	.173	-.308	.059	-.288	-.073	1	-.152	-.140	.109	.090	-.085	-.221	.429*	.064	-.126	.471**	.316	.297	.328	.585**	.678**	.506**	-.117	-.237	.504**	.596**	.361	-.079	-.109	-.144	.385
	Sig. (2-tailed)	.093	.004	.031	.076	.397	.361	.098	.762	.129	.702		.423	.504	.574	.638	.657	.269	.029	.747	.515	.010	.163	.111	.102	.002	.000	.005	.547	.216	.005	.001	.055	.691	.574	.447	.054
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q13	Pearson Correlation	.107	-.279	-.237	.025	.023	-.071	-.195	-.047	.016	.058	-.152	1	-.255	-.086	-.162	-.033	-.079	-.323	-.262	.516**	-.163	-.455*	.062	-.417*	-.329	-.108	-.084	-.122	-.016	-.024	-.266	-.094	-.491**	.083	.182	-.411
	Sig. (2-tailed)	.573	.136	.207	.894	.904	.711	.303	.811	.933	.762	.423		.218	.657	.393	.861	.696	.108	.178	.004	.397	.038	.746	.034	.101	.569	.666	.530	.933	.903	.163	.627	.008	.664	.335	.051
	N	30	30	30	30	30	30	30	29	29	30	30	31	25	29	30	30	27	26	28	29	29	21	30	26	26	30	29	29	29	29	29	29	28	30	30	31
Q14	Pearson Correlation	.154	-.401*	.244	.151	-.222	-.121	.246	.277	-.003	.194	-.140	-.255	1	.214	.484*	-.227	.041	-.039	-.156	.062	.015	0.000	-.108	-.166	.061	-.380	-.224	.037	.228	.084	.022	-.358	.401	.278	.187	-.394
	Sig. (2-tailed)	.461	.047	.239	.470	.287	.566	.226	.189	.990	.354	.504	.218		.316	.014	.276	.855	.860	.466	.773	.946	1.000	.607	.448	.781	.067	.292	.865	.285	.696	.919	.086	.058	.179	.371	.051
	N	25	25	25	25	25	25	26	24	25	25	25	25	26	24	25	25	22	23	24	24	24	18	25	23	23	24	24	24	24	24	24	24	23	25	25	26
Q15	Pearson Correlation	.213	.213	.063	.352	.385*	-.128	-.356	.173	-.497**	.051	.109	-.086	.214	1	.068	-.381*	-.438*	-.137	-.045	.089	.275	.158	-.050	-.089	.131	.191	.256	.198	-.126	-.212	-.132	.298	.038	.077	.102	.119
	Sig. (2-tailed)	.268	.268	.745	.061	.039	.510	.058	.378	.007	.791	.574	.657	.316		.727	.041	.025	.513	.824	.653	.156	.494	.796	.666	.523	.331	.188	.313	.522	.280	.505	.124	.849	.697	.599	.539
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	29	29	29	26	25	27	28	28	21	29	26	26	28	28	28	28	28	28	28	27	28	29	29
Q16	Pearson Correlation	.241	.106	.106	-.021	-.029	.303	.313	.149	.229	.406*	.090	-.162	.484*	.068	1	.049	.203	.023	-.107	.131	.022	.120	-.095	-.029	.082	.087	.261	.194	.052	-.108	.183	-.109	.407*	.194	-.060	.382*
	Sig. (2-tailed)	.199	.577	.577	.911	.880	.104	.092	.440	.232	.026	.638	.393	.014	.727		.796	.310	.911	.590	.498	.911	.606	.618	.889	.690	.654	.172	.312	.790	.578	.343	.575	.032	.313	.753	.038
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q17	Pearson Correlation	.060	-.052	.113	-.216	-.123	.003	.085	-.096	.352	.260	-.085	-.033	-.227	-.381*	.049	1	-.019	.204	.176	.098	-.588**	-.355	-.482**	-.070	-.298	-.247	-.149	.493**	.636**	-.211	-.385*	-.464*	.284	.151	-.079	-.041
	Sig. (2-tailed)	.754	.784	.551	.251	.518	.987	.657	.620	.061	.165	.657	.861	.276	.041	.796		.924	.318	.369	.614	.001	.114	.007	.735	.140	.197	.439	.007	.000	.272	.039	.011	.143	.435	.677	.830
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q19	Pearson Correlation	-.192	-.214	-.355	-.391*	-.100	.201	.320	-.062	.434*	.047	-.221	-.079	.041	-.438*	.203	-.019	1	.244	.181	-.103	.023	.129	.196	-.067	-.028	-.151	-.044	.070	-.132	-.220	.350	.100	.086	.151	-.073	-.056
	Sig. (2-tailed)	.338	.285	.069	.044	.621	.314	.091	.762	.024	.816	.269	.696	.855	.025	.310	.924		.239	.375	.609	.908	.600	.327	.756	.895	.452	.832	.735	.521	.281	.080	.627	.683	.442	.707	.771
	N	27	27	27	27	27	27	29	26	27	27	27	27	22	26	27	27	29	25	26	27	27	19	27	24	24	27	26	26	26	26	26	26	25	28	29	29
Q20	Pearson Correlation	.058	.162	-.071	-.078	.164	.039	.029	-.103	.108	.091	.429*	-.323	-.039	-.137	.023	.204	.244	1	.336	-.224	.196	.245	.067	.028	.383	.366	.170	.130	.059	.112	.230	.257	.100	.137	.047	.179
	Sig. (2-tailed)	.779	.428	.729	.705	.423	.852	.889	.623	.608	.659	.029	.108	.860	.513	.911	.318	.239		.101	.271	.336	.299	.745	.895	.059	.072	.416	.537	.780	.595	.268	.214	.644	.513	.821	.383
	N	26	26	26	26	26	26	26	25	25	26	26	26	23	25	26	26	25	26	25	26	26	20	26	25	25	25	25	25	25	25	25	25	24	25	26	26
Q21	Pearson Correlation	.116	-.034	.259	.212	-.131	-.233	-.299	.088	.038	.030	.064	-.262	-.156	-.045	-.107	.176	.181	.336	1	-.028	-.192	-.160	-.217	-.268	-.006	-.289	0.000	.335	.428*	0.000	0.000	0.000	.452*	-.187	-.275	_.433*
	Sig. (2-tailed)	.555	.863	.184	.279	.506	.232	.109	.661	.843	.879	.747	.178	.466	.824	.590	.369	.375	.101		.888	.327	.513	.267	.206	.977	.135	1.000	.087	.026	1.000	1.000	1.000	.018	.314	.157	.015
	N	28	28	28	28	28	28	30	27	30	28	28	28	24	27	28	28	26	25	31	28	28	19	28	24	24	28	27	27	27	27	27	27	27	31	28	31
Q22	Pearson Correlation	.403*	-.318	.202	.227	.191	.114	-.111	.289	.176	.324	-.126	.516**	.062	.089	.131	.098	-.103	-.224	-.028	1	-.323	-.314	-.212	-.539**	-.096	-.164	.024	.290	.297	-.201	-.221	-.273	-.257	.049	.034	.447*
	Sig. (2-tailed)	.030	.093	.294	.236	.321	.556	.568	.135	.369	.087	.515	.004	.773	.653	.498	.614	.609	.271	.888		.087	.178	.270	.005	.648	.406	.902	.134	.124	.306	.259	.160	.196	.803	.861	.035
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	27	26	28	29	29	20	29	25	25	28	28	28	28	28	28	28	27	28	29	29
Q23	Pearson Correlation	-.019	.373*	-.057	.282	-.003	.033	-.116	-.103	-.396*	-.194	.471**	-.163	.015	.275	.022	-.588**	.023	.196	-.192	-.323	1	.443	.663**	.034	.516**	.597**	.423*	-.328	-.686**	.281	.677**	.844**	-.202	-.121	.194	.044
	Sig. (2-tailed)	.922	.046	.770	.138	.990	.864	.547	.601	.037	.313	.010	.397	.946	.156	.911	.001	.908	.336	.327	.087		.050	.000	.872	.008	.001	.025	.088	.000	.147	.000	.000	.313	.539	.314	.822
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	27	26	28	29	29	20	29	25	25	28	28	28	28	28	28	28	27	28	29	29
Q24	Pearson Correlation	.204	.571**	-.063	-.247	.346	.016	-.110	.194	.212	-.158	.316	-.455*	0.000	.158	.120	-.355	.129	.245	-.160	-.314	.443	1	.455*	.258	.522*	.234	.128	.076	-.243	-.162	.429	.337	-.160	-.218	-.270	.433*
	Sig. (2-tailed)	.375	.007	.785	.280	.124	.946	.636	.413	.369	.494	.163	.038	1.000	.494	.606	.114	.600	.299	.513	.178	.050		.038	.259	.015	.307	.581	.743	.289	.483	.052	.135	.513	.355	.237	.050
	N	21	21	21	21	21	21	21	20	20	21	21	21	18	21	21	21	19	20	19	20	20	21	21	21	21	21	21	21	21	21	21	21	19	20	21	21
Q25	Pearson Correlation	-.085	.163	.107	.160	.072	-.079	-.321	-.021	-.119	-.304	.297	.062	-.108	-.050	-.095	-.482**	.196	.067	-.217	-.212	.663**	.455*	1	.156	.236	.332	.291	-.293	-.506**	.152	.434*	.616**	-.306	-.273	.015	-.072
	Sig. (2-tailed)	.653	.390	.574	.398	.707	.679	.084	.914	.540	.103	.111	.746	.607	.796	.618	.007	.327	.745	.267	.270	.000	.038		.445	.246	.078	.126	.123	.005	.432	.019	.000	.114	.152	.939	.704
	N	30	30	30	30	30	30	30	29	29	30	30	30	25	29	30	30	27	26	28	29	29	21	30	26	26	29	29	29	29	29	29	29	28	29	30	30
Q26	Pearson Correlation	-.531**	.427*	.093	-.123	-.032	.264	.016	-.154	-.220	-.205	.328	-.417*	-.166	-.089	-.029	-.070	-.067	.028	-.268	-.539**	.034	.258	.156	1	.010	.305	.256	-.356	-.331	.126	.026	-.013	.057	-.118	.016	-.143
	Sig. (2-tailed)	.005	.029	.652	.548	.877	.193	.939	.462	.291	.315	.102	.034	.448	.666	.889	.735	.756	.895	.206	.005	.872	.259	.445		.961	.138	.217	.080	.106	.549	.901	.952	.791	.574	.937	.477
	N	26	26	26	26	26	26	26	25	25	26	26	26	23	26	26	26	24	25	24	25	25	21	26	27	26	25	25	25	25	25	25	25	24	25	26	27
Q27	Pearson Correlation	.488*	.330	.026	.078	.159	.122	-.055	.140	-.198	-.091	.585**	-.329	.061	.131	.082	-.298	-.028	.383	-.006	-.096	.516**	.522*	.236	.010	1	.295	.019	-.095	-.340	.073	.432*	.352	-.086	-.118	-.114	.421*
	Sig. (2-tailed)	.011	.099	.900	.705	.439	.552	.791	.504	.342	.659	.002	.101	.781	.523	.690	.140	.895	.059	.977	.648	.008	.015	.246	.961		.153	.928	.653	.097	.728	.031	.085	.691	.574	.579	.032
	N	26	26	26	26	26	26	26	25	25	26	26	26	23	26	26	26	24	25	24	25	25	21	26	26	26	25	25	25	25	25	25	25	24	25	26	26
Q28	Pearson Correlation	.122	.645**	.046	.253	.140	.213	.176	-.188	-.210	-.136	.678**	-.108	-.380	.191	.087	-.247	-.151	.366	-.289	-.164	.597**	.234	.332	.305	.295	1	.615**	-.248	-.501**	.349	.589**	.643**	-.150	.422*	-.068	-.534**
	Sig. (2-tailed)	.527	.000	.812	.186	.470	.268	.312	.337	.249	.480	.000	.569	.067	.331	.654	.197	.452	.072	.135	.406	.001	.307	.078	.138	.153		.000	.203	.007	.069	.001	.000	.456	.013	.720	.000
	N	29	29	29	29	29	29	35	28	32	29	29	30	24	28	29	29	27	25	28	28	28	21	29	25	25	39	28	28	28	28	28	28	27	34	30	39
Q29	Pearson Correlation	-.038	.278	.282	.244	.362	.210	-.061	-.309	-.307	.239	.506**	-.084	-.224	.256	.261	-.149	-.044	.170	0.000	.024	.423*	.128	.291	.256	.019	.615**	1	-.085	-.403*	.185	.352	.556**	.016	-.121	-.305	.135
	Sig. (2-tailed)	.844	.144	.138	.201	.053	.275	.752	.109	.112	.211	.005	.666	.292	.188	.172	.439	.832	.416	1.000	.902	.025	.581	.126	.217	.928	.000		.661	.030	.336	.061	.002	.936	.539	.108	.486
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	26	25	27	28	28	21	29	25	25	28	29	29	29	29	29	29	27	28	29	29
Q30	Pearson Correlation	.373*	-.108	.163	-.024	.198	-.172	-.239	.259	.406*	.265	-.117	-.122	.037	.198	.194	.493**	.070	.130	.335	.290	-.328	.076	-.293	-.356	-.095	-.248	-.085	1	.704**	-.640**	-.196	-.265	.276	-.074	.042	.367
	Sig. (2-tailed)	.046	.578	.399	.900	.303	.373	.213	.183	.032	.166	.547	.530	.865	.313	.312	.007	.735	.537	.087	.134	.088	.743	.123	.080	.653	.203	.661		.000	.000	.309	.165	.163	.706	.830	.057
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	26	25	27	28	28	21	29	25	25	28	29	29	29	29	29	29	27	28	29	29
Q31	Pearson Correlation	.224	-.310	.268	-.094	-.169	-.187	-.085	.244	.364	.294	-.237	-.016	.228	-.126	.052	.636**	-.132	.059	.428*	.297	-.686**	-.243	-.506**	-.331	-.340	-.501**	-.403*	.704**	1	-.240	-.477**	-.657**	.296	-.021	.068	-.035
	Sig. (2-tailed)	.244	.101	.160	.627	.381	.332	.661	.211	.057	.122	.216	.933	.285	.522	.790	.000	.521	.780	.026	.124	.000	.289	.005	.106	.097	.007	.030	.000		.209	.009	.000	.133	.915	.727	.856
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	26	25	27	28	28	21	29	25	25	28	29	29	29	29	29	29	27	28	29	29
Q32	Pearson Correlation	-.068	.073	.245	.146	-.317	.258	.246	-.218	-.224	.051	.504**	-.024	.084	-.212	-.108	-.211	-.220	.112	0.000	-.201	.281	-.162	.152	.126	.073	.349	.185	-.640**	-.240	1	.403*	.165	-.139	-.204	-.227	0.534*
	Sig. (2-tailed)	.727	.708	.200	.450	.094	.177	.198	.266	.251	.791	.005	.903	.696	.280	.578	.272	.281	.595	1.000	.306	.147	.483	.432	.549	.728	.069	.336	.000	.209		.030	.392	.490	.299	.236	.035
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	26	25	27	28	28	21	29	25	25	28	29	29	29	29	29	29	27	28	29	29
Q33	Pearson Correlation	.090	.244	.010	.124	-.147	.219	.182	-.057	.125	-.127	.596**	-.266	.022	-.132	.183	-.385*	.350	.230	0.000	-.221	.677**	.429	.434*	.026	.432*	.589**	.352	-.196	-.477**	.403*	1	.455*	-.127	-.175	-.213	0.538*
	Sig. (2-tailed)	.642	.203	.960	.521	.445	.253	.345	.772	.527	.512	.001	.163	.919	.505	.343	.039	.080	.268	1.000	.259	.000	.052	.019	.901	.031	.001	.061	.309	.009	.030		.013	.527	.372	.266	.033
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	26	25	27	28	28	21	29	25	25	28	29	29	29	29	29	29	27	28	29	29
Q34	Pearson Correlation	-.010	.419*	-.085	.243	.314	-.058	-.079	-.206	-.376*	-.210	.361	-.094	-.358	.298	-.109	-.464*	.100	.257	0.000	-.273	.844**	.337	.616**	-.013	.352	.643**	.556**	-.265	-.657**	.165	.455*	1	-.219	-.020	-.033	.058
	Sig. (2-tailed)	.960	.024	.659	.205	.097	.764	.684	.294	.048	.275	.055	.627	.086	.124	.575	.011	.627	.214	1.000	.160	.000	.135	.000	.952	.085	.000	.002	.165	.000	.392	.013		.272	.920	.865	.764
	N	29	29	29	29	29	29	29	28	28	29	29	29	24	28	29	29	26	25	27	28	28	21	29	25	25	28	29	29	29	29	29	29	27	28	29	29
Q35	Pearson Correlation	-.143	-.155	.319	.209	-.260	-.149	.105	.244	-.136	-.037	-.079	-.491**	.401	.038	.407*	.284	.086	.100	.452*	-.257	-.202	-.160	-.306	.057	-.086	-.150	.016	.276	.296	-.139	-.127	-.219	1	-.053	-.074	-.150
	Sig. (2-tailed)	.466	.432	.098	.286	.182	.450	.596	.210	.491	.852	.691	.008	.058	.849	.032	.143	.683	.644	.018	.196	.313	.513	.114	.791	.691	.456	.936	.163	.133	.490	.527	.272		.787	.710	.445
	N	28	28	28	28	28	28	28	28	28	28	28	28	23	27	28	28	25	24	27	27	27	19	28	24	24	27	27	27	27	27	27	27	28	28	28	28
Q36	Pearson Correlation	.089	.068	-.325	-.035	-.043	-.161	.606**	.053	.304	-.051	-.109	.083	.278	.077	.194	.151	.151	.137	-.187	.049	-.121	-.218	-.273	-.118	-.118	.422*	-.121	-.074	-.021	-.204	-.175	-.020	-.053	1	.515**	-.769**
	Sig. (2-tailed)	.647	.727	.085	.857	.826	.403	.000	.787	.053	.791	.574	.664	.179	.697	.313	.435	.442	.513	.314	.803	.539	.355	.152	.574	.574	.013	.539	.706	.915	.299	.372	.920	.787		.001	.000
	N	29	29	29	29	29	29	46	28	41	29	29	30	25	28	29	29	28	25	31	28	28	20	29	25	25	34	28	28	28	28	28	28	28	52	37	52
Q37	Pearson Correlation	-.127	.025	-.141	.241	-.191	-.214	-.005	.135	-.084	-.068	-.144	.182	.187	.102	-.060	-.079	-.073	.047	-.275	.034	.194	-.270	.015	.016	-.114	-.068	-.305	.042	.068	-.227	-.213	-.033	-.074	.515**	1	-.702**
	Sig. (2-tailed)	.503	.894	.459	.200	.311	.256	.976	.484	.636	.720	.447	.335	.371	.599	.753	.677	.707	.821	.157	.861	.314	.237	.939	.937	.579	.720	.108	.830	.727	.236	.266	.865	.710	.001		.000
	N	30	30	30	30	30	30	37	29	34	30	30	30	25	29	30	30	29	26	28	29	29	21	30	26	26	30	29	29	29	29	29	29	28	37	38	38
Total	Pearson Correlation	.491**	.342	-.001	-.056	.270	.539**	-.501**	.323	-.167	.210	.233	-.141	-.330	.119	.382*	-.041	-.056	.179	.433*	.348	.044	.433*	-.072	-.143	.421*	-.534**	.135	.167	-.035	.073	.338	.058	-.150	-.769**	-.702**	1
	Sig. (2-tailed)	.006	.065	.996	.771	.150	.002	.000	.087	.285	.265	.216	.450	.099	.539	.038	.830	.771	.383	.015	.065	.822	.050	.704	.477	.032	.000	.486	.388	.856	.705	.073	.764	.445	.000	.000	
	N	30	30	30	30	30	30	52	29	43	30	30	31	26	29	30	30	29	26	31	29	29	21	30	27	26	39	29	29	29	29	29	29	28	52	38	63

*. Correlation is significant at the 0.05 level (2-tailed).

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

Table 4:03: RELIABILITY TESTS

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item -Total Correlation	Cronbach's Alpha if Item Deleted
Item 1	75.77	77.192	.328	.527
Item 2	75.69	77.231	.316	.527
Item 3	75.08	81.577	-.270	.570
Item 4	75.15	84.474	-.278	.684
Item 5	71.54	53.936	.359	.460
Item 6	74.69	58.064	.561	.416
Item 7	74.85	63.641	.597	.438
Item 8	73.15	84.641	-.488	.585
Item 9	74.62	60.756	.563	.428
Item 10	76.08	76.744	.646	.521
Item 13	73.62	83.923	-.455	.694
Item 14	75.15	83.474	-.340	.590
Item 16	74.31	65.897	.674	.445
Item 17	72.92	76.410	.300	.524
Item 20	74.46	75.769	.401	.517
Item 21	72.00	79.833	-.097	.547
Item 22	73.69	74.731	.301	.523
Item 23	75.54	79.103	-.025	.548
Item 24	75.23	78.359	-.038	.560
Item 25	75.38	80.423	-.309	.559
Item 26	75.54	83.603	-.383	.575
Item 28	75.85	76.141	.370	.518
Item 29	75.62	70.090	.676	.470
Item 30	73.54	75.269	.306	.532
Item 31	73.23	80.692	-.424	.561
Item 32	75.77	80.192	-.095	.556
Item 33	76.00	76.167	.410	.519
Item 34	75.38	73.423	.390	.406
Item 35	76.08	79.577	-.446	.443
Item 36	75.85	79.474	-.092	.448
Item 37	75.85	82.641	-.311	.568
Item 19	75.54	74.936	.588	.508
Item 27	75.77	80.859	-.231	.467

Table 4.04: RELIABILTY STATISTICS

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.789	.787	33

APPENDIX II

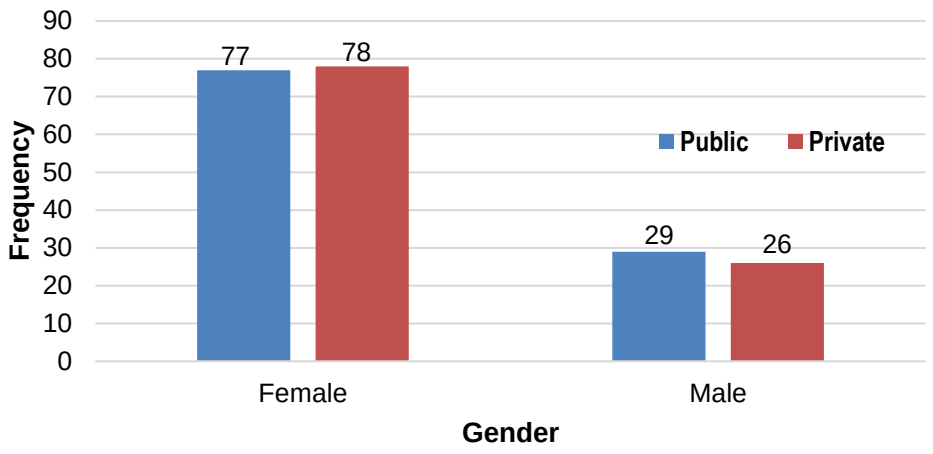

Figure A1: Gender

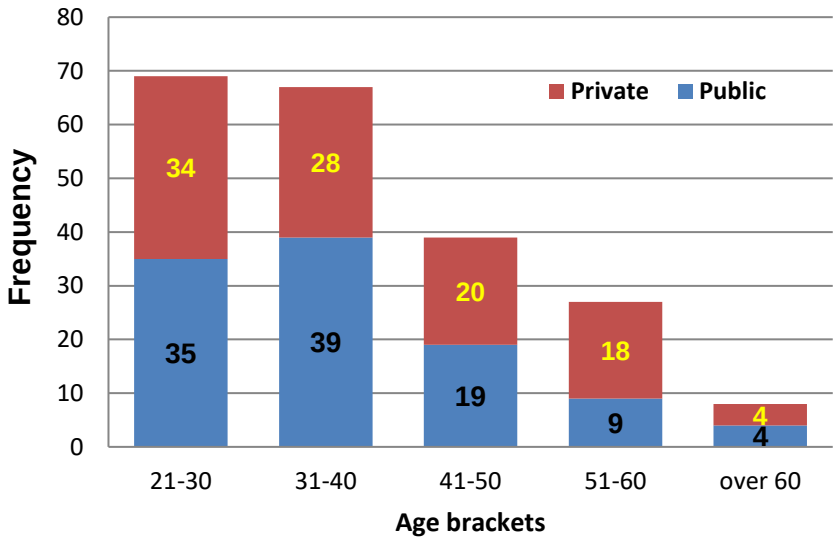

Figure A2: Age bracket

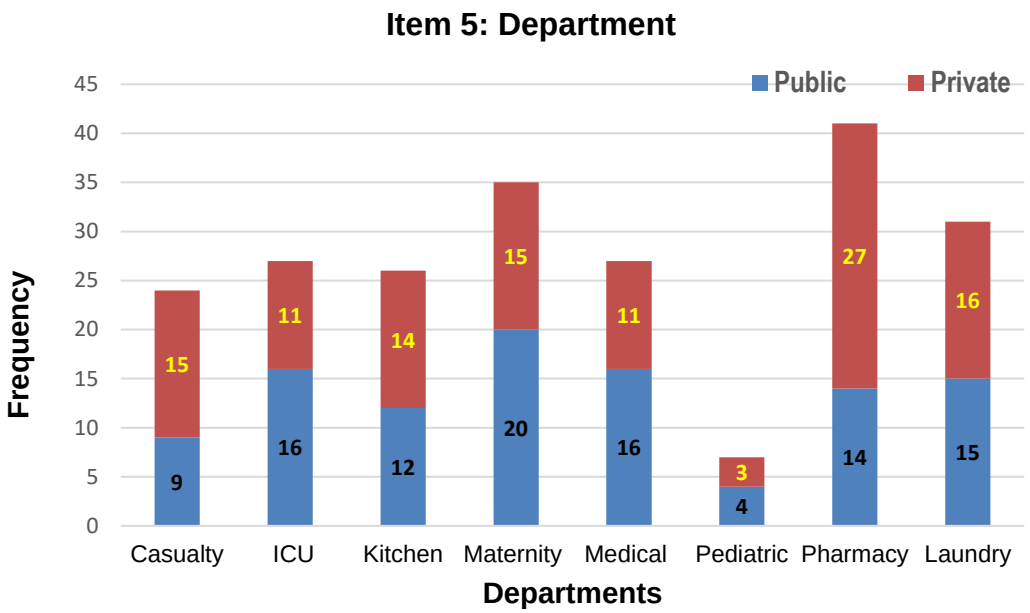

Figure A4: Departments

Crosstabs

Table A1: CASE PROCESSING SUMMARY

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Item 2 * Item 1	210	27.8%	545	72.2%	755	100.0%
Item 3 * Item 1	210	27.8%	545	72.2%	755	100.0%
Item 4 * Item 1	210	27.8%	545	72.2%	755	100.0%
Item 5 * Item 1	218	28.9%	537	71.1%	755	100.0%
Item 6 * Item 1	212	28.1%	543	71.9%	755	100.0%

b. Computed only for a 2x2 table

Item 2 * Item 1

Table A2: CROSSTAB FOR GENDER ACROSS THE TWO HOSPITALS

Count

		Item 1		Total
		1	2	
Item 2	1	77	78	155
	2	29	26	55
Total		**106**	**104**	**210**

Table A3: CHI-SQUARE TESTS FOR GENDER ACROSS THE TWO HOSPITALS

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.151[a]	1	.698		
Continuity Correction[b]	.054	1	.817		
Likelihood Ratio	.151	1	.697		
Fisher's Exact Test				.755	.409
Linear-by-Linear Association	.150	1	.698		
N of Valid Cases	210				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 27.24.

Item 3 * Item 1

Table A4: CROSSTAB FOR AGE BRACKET ACROSS THE TWO HOSPITALS

Count

		Item 1		Total
		1	2	
Item 3	1	35	34	69
	2	39	28	67
	3	19	20	39
	4	9	18	27
	5	4	4	8
Total		**106**	**104**	**210**

Item 4 * Item 1

Table A5: CROSSTAB FOR WORK EXPERIENCE ACROSS THE HOSPITALS

Count

		Item 1		Total
		1	2	
Item 4	1	32	31	63
	2	31	30	61
	3	43	43	86
Total		**106**	**104**	**210**

Table A6: CHI-SQUARE TESTS FOR WORK EXPERIENCE ACROSS THE TWO HOSPITALS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.013[a]	2	.993
Likelihood Ratio	.013	2	.993
Linear-by-Linear Association	.010	1	.920
N of Valid Cases	210		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 30.21.

Item 5 * Item 1

Table A7: CROSSTAB FOR DEPARTMENTS IN THE TWO HOSPITALS

Count

		Item 1		Total
		1	2	
Item 5	1	9	15	24
	2	16	11	27
	4	12	14	26
	5	20	15	35
	6	16	11	27
	7	4	3	7
	9	14	27	41
	10	15	16	31
Total		**106**	**112**	**218**

Table A8: CHI-SQUARE TESTS FOR THE TYPE OF DEPARTMENT ACROSS THE TWO HOSPITALS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.358[a]	7	.302
Likelihood Ratio	8.454	7	.294
Linear-by-Linear Association	.591	1	.442
N of Valid Cases	218		

a. 2 cells (12.5%) have expected count less than 5. The minimum expected count is 3.40.

Item 6 * Item 1

Table A9: CROSSTAB FOR JOB CATEGORY ACROSS THE TWO HOSPITALS

Count

		Item 1		Total
		1	**2**	
Item 6	1	47	38	85
	2	23	20	43
	3	0	1	1
	4	12	20	32
	5	2	3	5
	6	0	1	1
	7	21	23	44
	10	1	0	1
Total		**106**	**106**	**212**

8 cells (50.0%) have expected count less than 5. The minimum expected count is .50.

APPENDIX III

Crosstabs

Table B1: CASE PROCESSING SUMMARY

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Item 7 * Item 1	629	83.3%	126	16.7%	755	100.0%
Item 8 * Item 1	184	24.4%	571	75.6%	755	100.0%
Item 9 * Item 1	389	51.5%	366	48.5%	755	100.0%
Item 10 * Item 1	209	27.7%	546	72.3%	755	100.0%
Item 11 * Item 1	208	27.5%	547	72.5%	755	100.0%
Item 12 * Item 1	247	32.7%	508	67.3%	755	100.0%
Item 13 * Item 1	241	31.9%	514	68.1%	755	100.0%
Item 14 * Item 1	155	20.5%	600	79.5%	755	100.0%
Item 15 * Item 1	206	27.3%	549	72.7%	755	100.0%
Item 16 * Item 1	199	26.4%	556	73.6%	755	100.0%
Item 17 * Item 1	210	27.8%	545	72.2%	755	100.0%
Item 18 * Item 1	471	62.4%	284	37.6%	755	100.0%

Item 7 * Item 1

Table B2: CROSSTAB FOR THE TYPE OF WASTE GENERATED IN THE DEPARTMENTS

Count

		Item 1		Total
		1	2	
Item 7	1	85	89	174
	2	25	31	56
	3	85	75	160
	4	28	24	52
	5	13	12	25
	6	80	77	157
	7	2	3	5
Total		**318**	**311**	**629**

Table B3: CHI-SQUARE TESTS FOR HCW SEGREGATION ACROSS THE TWO HOSPITALS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.887[a]	6	.930
Likelihood Ratio	1.890	6	.930
Linear-by-Linear Association	.224	1	.636
N of Valid Cases	629		

a. 2 cells (14.3%) have expected count less than 5. The minimum expected count is 2.47.

Item 8 * Item 1

Table B4: CROSSTAB OF HCW SEGREGATION

Count

		Item 1		Total
		1	2	
Item 8	1	5	2	7
	2	2	0	2
	3	6	7	13
	4	55	53	108
	5	22	32	54
Total		**90**	**94**	**184**

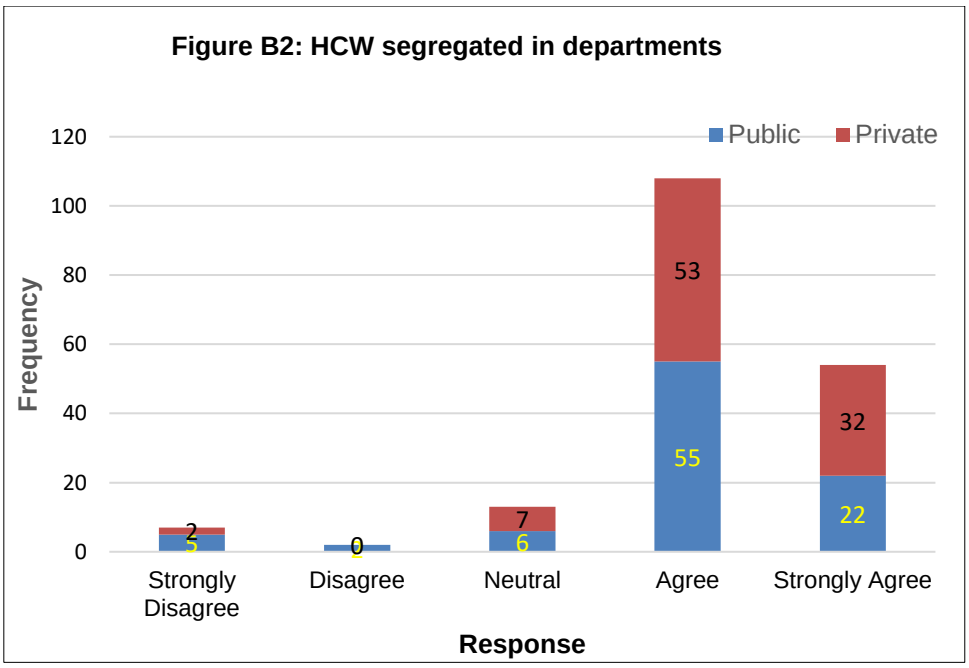

Figure B2: HCW segregated in departments

4 cells (40.0%) have expected count less than 5. The minimum expected count is .98.

Item 9 * Item 1

Table B5: CROSSTAB FOR WHO SEPARATES HCW IN THE DEPARTMENT

Count

		Item 1		Total
		1	2	
Item 9	1	70	70	140
	2	34	10	44
	3	2	2	4
	4	4	2	6
	5	78	74	152
	6	12	2	14
	7	5	7	12
	8	4	3	7
	9	5	5	10
Total		**214**	**175**	**389**

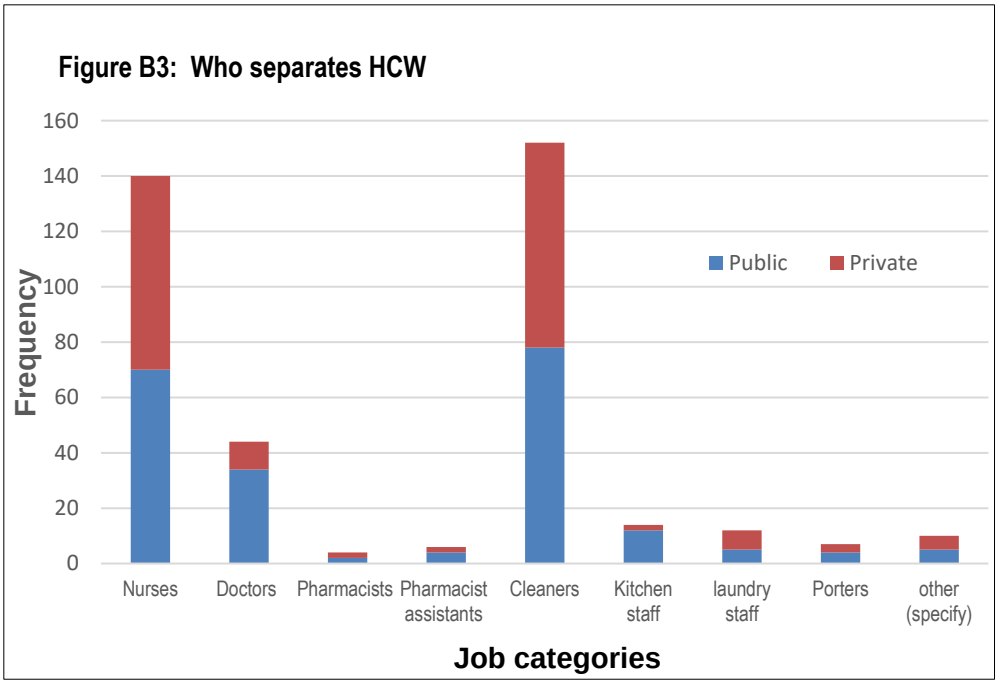

Figure B3: Who separates HCW

7 cells (38.9%) have expected count less than 5. The minimum expected count is 1.80.

Item 11 * Item 1

Table B7: CROSSTAB FOR INSTRUCTIVE POSTERS IN THE DEPARTMENTS

Count

		Item 1		Total
		1	**2**	
Item 11	1	80	74	154
	2	19	13	32
	3	6	16	22
Total		**105**	**103**	**208**

Table B8: CHI-SQUARE TESTS FOR EXISTENCE OF INSTRUCTIVE POSTERS ACROSS THE TWO HOSPITALS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.886[a]	2	.053
Likelihood Ratio	6.063	2	.048
Linear-by-Linear Association	2.342	1	.126
N of Valid Cases	208		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.89.

Table B10: CHI-SQUARE TESTS FOR TYPES OF BAGS USED FOR DIFFERENT HCW

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.140[a]	3	.105
Likelihood Ratio	6.464	3	.091
Linear-by-Linear Association	.357	1	.550
N of Valid Cases	247		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.23.

Item 13 * Item 1

Table B11: CROSSTAB FOR BAGS USED FOR GENERAL HCW

Count

		Item 1		Total
		1	2	
Item 13	1	19	16	35
	2	11	13	24
	3	0	3	3
	4	89	66	155
	5	11	13	24
Total		**130**	**111**	**241**

Table B12: CHI-SQUARE TESTS FOR CONTAINER USED TO COLLECT SHARP WASTE

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.540[a]	4	.236
Likelihood Ratio	6.676	4	.154
Linear-by-Linear Association	.112	1	.737
N of Valid Cases	241		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 1.38.

Item 14 * Item 1

Table B13: CROSSTAB FOR THE TYPE OF BAG USED FOR PHARMACEUTICAL HCW

Count

		Item 1		Total
		1	2	
Item 14	1	55	34	89
	2	4	8	12
	3	6	10	16
	4	23	13	36
	5	1	1	2
Total		**89**	**66**	**155**

Table B14: CHI-SQUARE TESTS FOR TYPES OF BAGS USED FOR DIFFERENT TYPES OF WASTE

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.803[a]	4	.147
Likelihood Ratio	6.761	4	.149
Linear-by-Linear Association	.126	1	.723
N of Valid Cases	155		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is .85.

Item 15 * Item 1

Table B15: CROSSTAB FOR TYPE OF CONTAINER USED FOR SHARP HCW

Count

		Item 1		Total
		1	2	
Item 15	1	7	4	11
	2	2	0	2
	4	1	0	1
	5	88	96	184
	6	5	3	8
Total		**103**	**103**	**206**

Table B16: CHI-SQUARE TESTS CHI-SQUARE TESTS FOR THE TYPES OF BAGS USED FOR DIFFERENT TYPES OF HCW

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.666[a]	4	.323
Likelihood Ratio	5.841	4	.211
Linear-by-Linear Association	1.482	1	.223
N of Valid Cases	206		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .50.

Item 16 * Item 1

Table B17: CROSSTAB FOR THE ITEM WHICH ASSESSED IF HCW BAGS ARE SUBJECTS TO TEAR

Count

		Item 1		Total
		1	2	
Item 16	1	12	16	28
	2	43	30	73
	3	14	22	36
	4	21	16	37
	5	12	13	25
Total		**102**	**97**	**199**

Table B18: CHI-SQUARE TESTS FOR THE ITEM WHICH ASSESSED IF HCW BAGS ARE SUBJECT TO TEAR

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.258[a]	4	.262
Likelihood Ratio	5.286	4	.259
Linear-by-Linear Association	.003	1	.958
N of Valid Cases	199		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.19.

Item 17 * Item 1

Table B19: CROSSTAB FOR USE OF PROTECTIVE CLOTHING

		Item 1		Total
		1	2	
Item 17	1	10	4	14
	2	9	4	13
	3	11	8	19
	4	50	63	113
	5	30	21	51
Total		**110**	**100**	**210**

Table B20: CHI-SQUARE TESTS FOR USE OF PROTECTIVE CLOTHING

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.593[a]	4	.108
Likelihood Ratio	7.725	4	.102
Linear-by-Linear Association	1.697	1	.193
N of Valid Cases	210		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.19.

Item 18 * Item 1

Table B21: CROSSTAB FOR TYPE OF PROTECTIVE CLOTHING WORN WHEN HANDLING HCW

Count

		Item 1		Total
		1	2	
Item 18	1	100	98	198
	2	67	61	128
	3	58	25	83
	4	15	12	27
	5	18	12	30
	6	4	1	5
Total		**262**	**209**	**471**

Table B22: CHI-SQUARE TESTS FOR ITEM WHICH ASSESSED TYPE OF PROTECTIVE CLOTHING WORN WHEN HANDLING HCW

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.930[a]	5	.053
Likelihood Ratio	11.285	5	.046
Linear-by-Linear Association	5.206	1	.023
N of Valid Cases	471		

a. 2 cells (16.7%) have expected count less than 5. The minimum expected count is 2.22.

Crosstabs

CASE PROCESSING SUMMARY

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Item 19 * Item 1	237	31.4%	518	68.6%	755	100.0%
Item 20 * Item 1	190	25.2%	565	74.8%	755	100.0%
Item 21 * Item 1	232	30.7%	523	69.3%	755	100.0%
Item 22 * Item 1	193	25.6%	562	74.4%	755	100.0%
Item 23 * Item 1	203	26.9%	552	73.1%	755	100.0%
Item 24 * Item 1	163	21.6%	592	78.4%	755	100.0%
Item 25 * Item 1	203	26.9%	552	73.1%	755	100.0%
Item 26 * Item 1	192	25.4%	563	74.6%	755	100.0%
Item 27 * Item 1	173	22.9%	582	77.1%	755	100.0%

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Item 20 * Item 1

Table B24: CROSSTAB FOR HOW OFTEN IS THE COLLECTION OF HCW

		Item 1		**Total**
		1	**2**	
Item 20	1	16	4	20
	2	22	22	44
	3	55	60	115
	4	6	5	11
Total		**99**	**91**	**190**

Table B25: CHI-SQUARE TESTS FOR HOW OFTEN THE WASTE IS COLLECTED FROM THE DEPARTMENT

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	7.184[a]	3	.066
Likelihood Ratio	7.681	3	.053
Linear-by-Linear Association	3.699	1	.054
N of Valid Cases	190		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.27.

Item 21 * Item 1

Table B26: CROSSTAB FOR WHO COLLECTS HCW

Count

		Item 1		Total
		1	**2**	
Item 21	1	6	6	12
	2	2	0	2
	3	2	0	2
	4	5	1	6
	5	91	95	186
	6	4	0	4
	7	5	3	8
	8	6	3	9
	9	1	2	3
Total		**122**	**110**	**232**

14 cells (77.8%) have expected count less than 5. The minimum expected count is .95.

Item 22 * Item 1

Table B27: CROSSTAB FOR THE ITEM WHICH ASSESSED THE STORAGE ROOM SUFFICIENCY

Count

		Item 1		Total
		1	**2**	
Item 22	1	8	0	8
	2	13	4	17
	3	36	30	66
	4	27	47	74
	5	13	15	28
Total		**97**	**96**	**193**

Item 23 * Item 1

Table B29: CROSSTAB FOR ITEM WHICH ASSESSED IF THE STORAGE AREA IS LOCKABLE

Count

		Item 1		Total
		1	2	
Item 23	1	31	64	95
	2	32	6	38
	3	40	30	70
Total		**103**	**100**	**203**

Table B30: CHI-SQUARE TESTS FOR ITEM WHICH ASSESSED IF THE STORAGE AREA IS LOCKABLE

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	30.644[a]	2	.000
Likelihood Ratio	32.626	2	.000
Linear-by-Linear Association	11.562	1	.001
N of Valid Cases	203		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.72.

Item 24 * Item 1

Table B31: CROSSTAB FOR THE LENGTH OF STORAGE OF HCW

Count

		Item 1		Total
		1	2	
Item 24	1	63	55	118
	2	3	0	3
	3	1	3	4
	4	17	21	38
Total		**84**	**79**	**163**

4 cells (50.0%) have expected count less than 5. The minimum expected count is 1.45.

Item 25 * Item 1

Table B32: CROSSTAB FOR WHETHER HCW IS WEIGHED

Count

		Item 1		Total
		1	2	
Item 25	1	11	53	64
	2	28	6	34
	3	64	41	105
Total		**103**	**100**	**203**

Table B33: CHI-SQUARE TESTS FOR THE ITEM WHICH ASSESSED IF THE HOSPITALS WEIGHED WASTE

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	46.802[a]	2	.000
Likelihood Ratio	50.471	2	.000
Linear-by-Linear Association	25.679	1	.000
N of Valid Cases	203		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.75.

Item 26 * Item 1

Table B34: CROSSTAB FOR OFFSITE TRANSPORTATION

Count

		Item 1		Total
		1	2	
Item 26	1	17	80	97
	2	72	6	78
	3	9	8	17
Total		**98**	**94**	**192**

TABLE B35: CHI-SQUARE TESTS ON TYPE OF TRANSPORTATION USED BY THE TWO HOSPITALS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	96.781[a]	2	.000
Likelihood Ratio	110.231	2	.000
Linear-by-Linear Association	53.201	1	.000
N of Valid Cases	192		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.32.

Item 27 * Item 1

Table B36: CROSSTAB FOR HOW OFTEN THE HCW WAS COLLECTED TO THE TREATMENT FACILITY

Count

		Item 1		Total
		1	2	
Item 27	1	71	53	124
	2	8	11	19
	3	3	1	4
	4	1	1	2
	5	7	17	24
Total		**90**	**83**	**173**

4 cells (40.0%) have expected count less than 5. The minimum expected count is .96.

APPENDIX IV

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Item 28 * Item 1	318	42.1%	437	57.9%	755	100.0%
Item 29 * Item 1	199	26.4%	556	73.6%	755	100.0%
Item 30 * Item 1	204	27.0%	551	73.0%	755	100.0%
Item 31 * Item 1	200	26.5%	555	73.5%	755	100.0%
Item 32 * Item 1	205	27.2%	550	72.8%	755	100.0%
Item 33 * Item 1	206	27.3%	549	72.7%	755	100.0%
Item 34 * Item 1	205	27.2%	550	72.8%	755	100.0%
Item 35 * Item 1	202	26.8%	553	73.2%	755	100.0%
Item 36 * Item 1	474	62.8%	281	37.2%	755	100.0%
Item 37 * Item 1	311	41.2%	444	58.8%	755	100.0%

Item 28 * Item 1

Table C1: CROSSTAB ON ITEM WHICH ASSESSED WHETHER RESPONDENT RECEIVED TRAINING ON HCW MANAGEMENT

Count

		Item 1		Total
		1	2	
Item 28	1	47	129	176
	2	56	29	85
	3	3	10	13
	4	23	13	36
	6	5	0	5
	7	3	0	3
Total		**137**	**181**	**318**

4 cells (33.3%) have expected count less than 5. The minimum expected count is 1.29.

Item 29 * Item 1

Table C2: CROSSTAB ON WHETHER NEW EMPLOYEES ARE GIVEN TRAINING ON HCW MANAGEMENT

Count

		Item 1		Total
		1	2	
Item 29	1	40	73	112
	2	24	5	29
	3	34	23	57
Total		**98**	**101**	**199**

2 cells (25.0%) have expected count less than 5. The minimum expected count is .49.

Item 30 * Item 1

Table C3: CROSSTAB ON WHETHER HCW IS MANAGED EFFECTIVELY IN THE HOSPITAL

Count

		Item 1		Total
		1	2	
Item 30	1	6	0	6
	2	12	1	13
	3	41	23	64
	4	28	59	87
	5	14	20	34
Total		**101**	**103**	**204**

Table C4: CHI-SQUARE TESTS CHI-SQUARE TESTS ON WHETHER HCW IS MANAGED EFFECTIVELY ACROSS THE HOSPITALS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	32.459[a]	4	.000
Likelihood Ratio	36.757	4	.000
Linear-by-Linear Association	23.534	1	.000
N of Valid Cases	204		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 2.97.

Item 31 * Item 1

Table C5: CROSSTAB ON WHETHER HCW IS BEING MANAGED ACCORDING TO THE POLICY IN THE HOSPITALS

Count

		Item 1		Total
		1	2	
Item 31	1	4	0	4
	2	6	0	6
	3	43	27	70
	4	29	53	82
	5	17	21	38
Total		**99**	**101**	**200**

4 cells (40.0%) have expected count less than 5. The minimum expected count is 1.98.

Item 32 * Item 1

Table C6a: CROSSTAB ON DOCUMENT OUTLINING THE HCW POLICY

Count

		Item 1		Total
		1	2	
Item 32	1	54	66	120
	2	22	16	38
	3	25	22	47
Total		**101**	**104**	**205**

Table C6b: CHI-SQUARE TESTS ON DOCUMENT OUTLINING HCW

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.295[a]	2	.317
Likelihood Ratio	2.301	2	.316
Linear-by-Linear Association	1.370	1	.242
N of Valid Cases	205		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.72.

Item 33 * Item 1

Table C7: CROSSTAB ON HOSPITAL MANAGEMENT TEAM

Count

		Item 1		Total
		1	**2**	
Item 33	1	61	78	139
	2	5	1	6
	3	36	25	61
Total		**102**	**104**	**206**

Table C8: CHI-SQUARE TESTS ON HOSPITAL MANAGEMENT TEAM

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	6.711[a]	2	.035
Likelihood Ratio	6.970	2	.031
Linear-by-Linear Association	4.333	1	.037
N of Valid Cases	206		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.97.

Item 34 * Item 1

Table C9: CROSSTAB ON THE EXISTENCE OF RECORDS ON HCW MANAGEMENT

Count

		Item 1		Total
		1	**2**	
Item 34	1	36	58	94
	2	6	1	7
	3	59	45	103
Total		**101**	**104**	**205**

Table C10:CHI-SQUARE TESTS ON THE TREATMENT OF HCW

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.863[a]	3	.008
Likelihood Ratio	12.694	3	.005
Linear-by-Linear Association	2.876	1	.090
N of Valid Cases	205		

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .49.

Item 35 * Item 1

Table C11: CROSSTAB ON HOW HCW IS TREATED

Count

		Item 1		Total
		1	2	
Item 35	1	94	87	181
	2	6	4	10
	3	1	2	3
	4	3	5	8
Total		**104**	**98**	**202**

5 cells (62.5%) have expected count less than 5. The minimum expected

Item 36 * Item 1

Table C12: CROSSTAB ON RISKS TO HUMAN HEALTH

Count

		Item 1		Total
		1	2	
Item 36	1	93	92	185
	2	81	73	154
	3	70	57	127
	4	3	5	8
Total		**247**	**227**	**474**

Table C13: CHI-SQUARE TESTS ON RISKS TO HUMAN HEALTH

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.410[a]	3	.703
Likelihood Ratio	1.415	3	.702
Linear-by-Linear Association	.281	1	.596
N of Valid Cases	474		

a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 3.83.

Item 37 * Item 1

Table C14: CROSSTAB ON RISKS OF HCW TO THE ENVIRONMENT

Count

		Item 1		Total
		1	2	
Item 37	1	86	90	176
	2	57	64	121
	3	10	4	14
Total		**153**	**158**	**311**

Table C15: CHI-SQUARE TESTS ON RISKS OF HCW

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.988[a]	2	.225
Likelihood Ratio	3.072	2	.215
Linear-by-Linear Association	.516	1	.472
N of Valid Cases	311		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.89.

APPENDIX V

Plate 5.1: Incinerator operator wearing protective clothing

Plate 5.2a: Cold storage area at the treatment facility

Plate 5.2b: HCW bags on shelves in the cold storage area at the treatment facility

Plate 5.3: Incinerator operator feeding HCW bags into the incinerator

Plate 5.4: HCW ash residue from the incinerator

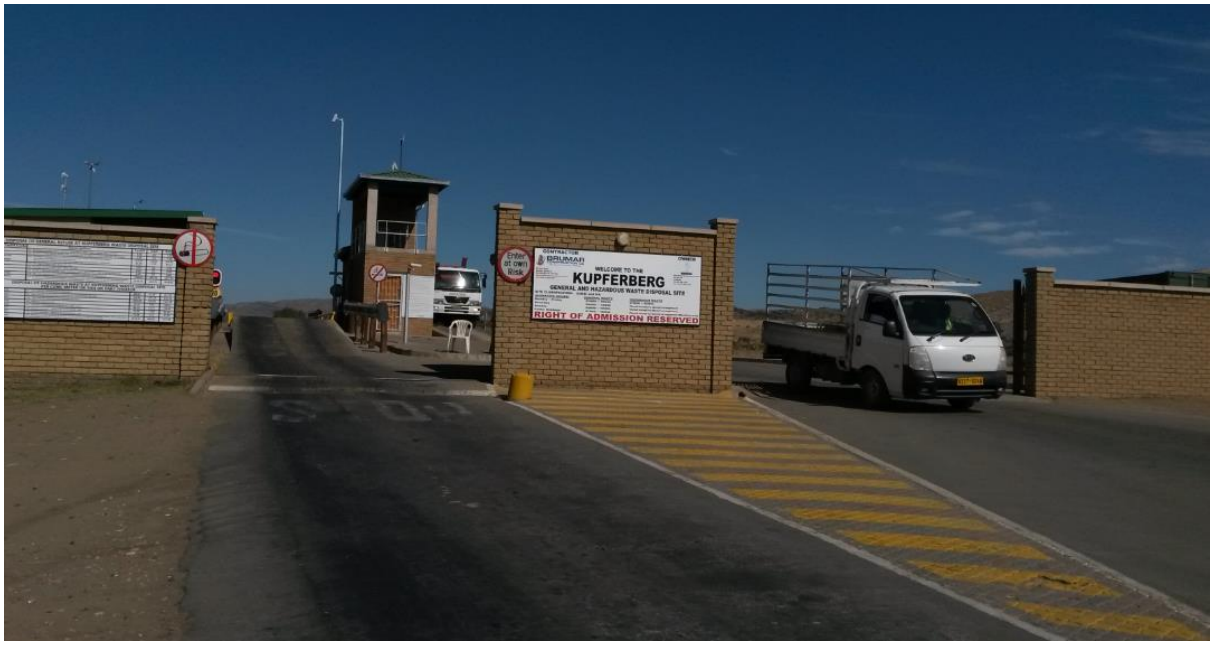

Plate 5.5: Landfill site (Kupferberg)

Plate 5.6a: Hazardous cell for burying of hazardous residues of infectious waste (Kupferberg landfill site)

Plate 5.6b: final disposal site for hazardous ash (hazardous cell), a truck in action compressing the ash

Plate 5.7: City of Windhoek HCW treatment facility under construction

ANNEXURES

ANNEXURE A

Ethical clearance

UNISA university of south africa

UNIVERSITY OF SOUTH AFRICA
Health Studies Higher Degrees Committee
College of Human Sciences
ETHICAL CLEARANCE CERTIFICATE

REC-012714-039

Date: 3 February 2016

HSHDC/SCI/2016

Student No: 5514-525-2

Project Title: An investigation of the Healthcare waste management practices at a public and private hospital in Namibia.

Researcher: Memory Mushipe

Degree: MA in Nursing Science

Supervisor: Prof PR Risenga
Qualification: D Cur
Joint Supervisor: -

Code: MPCH594

DECISION OF COMMITTEE

Approved [√]

Conditionally Approved [ ]

for **Prof L Roets**
CHAIRPERSON: HEALTH STUDIES HIGHER DEGREES COMMITTEE
Prof LR Roets

Prof MM Moleki
ACADEMIC CHAIRPERSON: DEPARTMENT OF HEALTH STUDIES

PLEASE QUOTE THE PROJECT NUMBER IN ALL ENQUIRES

ANNEXURE B

Approval letter from the MoHSS

REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
Windhoek

Tel: 061 – 203 2510
Fax: 061 – 222558
E-mail: Ester.Shaama@mhss.gov.na

OFFICE OF THE PERMANENT SECRETARY

Ref: 17/3/3
Enquiries: Ms. E.N. Shaama

Date: 10th May 2016

Ms. Memory Mushipe
P.O. Box 91034
Klein Windhoek
Namibia

Dear Ms. Mushipe

Re: An investigation of the Healthcare Waste Management practices at a Public and Private Hospital in Namibia

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**

3.1 The data to be collected must only be used for academic purpose;
3.2 No other data should be collected other than the data stated in the proposal;
3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects' information should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;
3.4 A quarterly report to be submitted to the Ministry's Research Unit;
3.5 Preliminary findings to be submitted upon completion of the study;
3.6 Final report to be submitted upon completion of the study;

3.7 Separate permission should be sought from the Ministry of Health and Social Services for the publication of the findings.

Yours sincerely,

PERMANENT SECRETARY
11 MAY 2016
REPUBLIC OF NAMIBIA
MINISTRY OF HEALTH AND SOCIAL SERVICES

Andreas Mwoombola (Dr)
Permanent Secretary

"Health for All"

ANNEXURE C

Approval letter from data collection site, Public hospital.

Republic of Namibia

Ministry of Health and Social Services

Private Bag 13215 **WINDHOEK** Namibia	Intermediate Hospital Katutura Independence Avenue **WINDHOEK**	Telephone (061) 203 4004 Telefax (061) 222706

Enquiries: Dr. F. M. Shiweda

Date: 26 May 2016

THE OFFICE OF THE CHIEF MEDICAL OFFICER

Ms. Memory Mushipe
P. O. Box 91034
Klein Windhoek
Namibia

RE: PERMISSION TO DO RESEARCH IN INVESTIGATING OF THE HEALTH WASTE MANAGEMENT AT INTERMEDIATE HOSPITAL KATUTURA

This office hereby grants you permission to do research in investigation of the Health Waste Management practices at Intermediate Hospital Katutura.

Thank you.

Yours in Health,

DR. F. M. SHIWEDA
CHIEF MEDICAL OFFICER

MINISTRY OF HEALTH
AND SOCIAL SERVICES
P/BAG 13215
WINDHOEK NAMIBIA
26 -05- 2016
INTERMEDIATE HOSPITAL KATUTURA

ANNEXURE D

Approval letter from data collection site, Private hospital

MEDICLINIC

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ETHICS LINE 0800 005 316

www.mediclinic.co.za

3 May 2016

Ms M Mushipe
PO Box 91034
Klein Windhoek
Windhoek
NAMIBIA

Dear Memory

PERMISSION TO CONDUCT RESEARCH AT MEDICLINIC WINDHOEK

Your research proposal entitled *"An investigation of the Healthcare waste management practices at a public and private hospital in Namibia"* refers.

It is in order for you to conduct your research at Mediclinic Windhoek, and I wish you success with this project.

Yours sincerely

Estelle Coustas

DR ESTELLE COUSTAS
Nursing Executive

MEDICLINIC (PTY) LTD
REG. NO. 1969/009218/07

Annexure E

Approval letter from data collection site, Kupferberg Landfill site

SOLID WASTE MANAGEMENT DIVISION

P.O. Box 50490
Bachbrecht
New Castle Street
WINDHOEK, NAMIBIA

Tel: +264 61 290 3111 Fax: +264 61 290 2844

City of Windhoek

Enquiries: Mr. SA Tsauseb
Tel: 061-290 3110
Fax: 061-2902844

02 August 2016

ATT: Ms. M Mushipe
P.O Box 91034
Klein Windhoek
Namibia

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT KUPFERBERG LANDFILL SITE

Dear Madam,

Your request regarding permission to access site for academic research purposes has reference.

Your initiative to conduct research on our facility is commended, and your request is hereby granted.

Kindly be informed that permission to conduct the research has been granted under the following conditions:

- The data and information collected must only be used for academic purposes;
- No other data should be collected other than what was requested for in your proposal/request;
- Preliminary findings to be submitted upon completion of the study to the under-signed;
- Final report to be submitted upon completion of your study to the under-signed;
- Separate permission should be sought from the City of Windhoek for the publication of the findings

The operation and maintenance of the Kupferberg landfill site has been outsourced to an independent Contractor, BruMar Construction CC. You are therefore requested to liaise with the site supervisor, Mr. Chris Katzao at 061-257174 / Cell: 081 1283881 regarding the arrangements for accessing site and collecting data.

You are requested to present this letter at the access office, every time you require access to the site.

Please do not hesitate to contact our office should you have queries with regards to the above.

Yours faithfully,

.....

SA Tsauseb
Section Engineer: Treatment, Disposal Facilities and Technical Support
Solid Waste Management Division
City of Windhoek

ANNEXURE F

Informed consent

CONSENT FORM

TITLE OF THE RESEARCH PROJECT:

An Investigation of the HCW practices at Public State Hospital and Private Hospital.

Study Goals

The aim of the study is to investigate and compare the health care waste practices at Public State Hospital and Private Hospital. The study will involve use of Questionnaires which will be issued to selected study participants in the form of a hard copy at participants various working departments. The questionnaire will be used to assess and get information on the type of health care waste generated at the hospitals, waste handling, segregation, storage, transportation and disposal.

Research process

The researcher will also do site visits and use observation sheets to validate on the information acquired from questionnaires. The researcher will be recording the things which will be observed during site visits. The researcher is not going to video tape the participants instead the researcher will only use a digital camera to take pictures of the waste at different sites.

The study is a cross sectional survey study and data will only be collected once from participants. There is no right or wrong answers and all your opinions will be valued. Participant selection will be through random sampling and the researcher will visit you at your working stations. The questionnaire will take on average 40 to 60 minutes to be completed.

Confidentiality

Participant's privacy will be protected at all times. The opinions of every participant will be treated as private and confidential and no names will be written on the questionnaire and no names will be published in the research report and your anonymity is therefore assured.

Potential risk and Benefits

The researcher does not anticipate any risk to you in participating in the study except for those involved directly in the sorting ,weighing and transportation of health care waste who have a possibility of getting injured in the process therefore use of company protective clothes is urged to prevent injuries.

The study is meant to create awareness and improve the HCW management practices in the healthcare facilities. The findings will help to add on the existing knowledge on HCW management and to improve on the existing practices and also to aid in amending of policies in order to reduce the impacts health care waste poses both to people and the environment.

Contact information

In the event of you having additional or further questions, you may contact the supervisor, Professor Patrone Rebecca Risenga at the following address:

Department of Health Studies
Theo Van Wyk 7-154
P.O Box 392
UNISA
Telephone: +12 429-6769
Email: risen@unisa.ac.za

Consent statement

I, the undersigned……(full names), have read the above information and it has been explained to me verbally and I understand it. I have been given answers to the questions I have asked and I do hereby declare that I voluntarily consent to take part in the study and I can withdraw from the study at any given time.
I shall not hold the university or any of its employees or students against any liability that I may incur during the course of the study. I further undertake that I shall not make any claims in respect to damage to my person that may occur during the study period unless if its due to the negligence on the part of the university, its employees and students.

I have received a signed consent of this consent form.

Signature of participant…….

Signed at……

On……..……..place……..

Witness

1……

2……

ANNEXURE G

Questionnaire

APPENDIX B: Covering Letter

AN INVESTIGATION OF HEALTH CARE WASTE MANAGEMENT PRACTICES AT PUBLIC STATE HOSPITAL and PRIVATE IN KHOMAS REGION IN NAMIBIA.

To the Respondent

I am a student studying for a Master's degree in Nursing with the University of South Africa. As part of the requirement for my programme, I have to submit a dissertation to the Academic Council. The topic I have chosen is: An investigation of HCW management practices at a public hospital and private hospital in Khomas Region in Namibia.

In this regard a survey is being carried out on the health care waste management practices at your hospital and the study would be seeking to obtain your perceptions and views regarding various aspects of HCW management. The study will be purely for academic purposes and is a requirement in partial fulfilment for the completion of a Master's degree in Nursing with the University of South Africa.

The information which will be collected will be kept in strict confidence and names will not in any way be associated with comments made. The researcher and the University will only have access to the information provided and the results will be used for academic and research purposes. Also note that there are no correct or wrong answers but your honest participation in answering the questions will assist in establishing the HCW management practices currently available at your hospital.

As a participant you are encouraged to take part and answer questions to the best of your ability and you are reminded that participation in this survey is voluntary and you can feel free to withdraw at any given time without obligations.

I wish to reiterate my appreciation and heartfelt thanks to you for devoting some of your precious time in responding to this survey. The questionnaire will take approximately thirty minutes to complete.

Yours faithfully

Memory Mushipe

Tel: +264813501184

Email: memorymushipe@yahoo.com

AN INVESTIGATION OF THE HCW MANAGEMENT PRACTICE AT A PUBLIC AND PRIVATE HOSPITAL IN KHOMAS REGION, NAMIBIA.

(Please note that all information provided will be treated confidentially)
(PLEASE TICK [√] IN THE APPROPRIATE BOX)

SECTION A: DEMOGRAPHIC DATA

1. What is the name of your hospital?

Public State Hospital	
Private Hospital	

2. What is your gender?

Female	
Male	

3. In which age bracket do you fall?

21-30	
31-40	
41-50	
51-60	
over 60	

4. What is your period of work experience in the hospital?

Less than 1 year	
1-5 years	
More than 5years	

5. State your department?

Emergency centre (casualty)	
Intensive care unit(ICU)	

Maternity Ward	
Medical Ward	
Paediatric Ward	
Pharmacy	
Theatre	

6. What is your job category?

Registered Nurse	
Enrolled Nurse	
Enrolled Nurse Assistant	
Doctor	
Pharmacist	
Cleaner	
Pharmacist assistant	

SECTION B: HCW MANAGEMENT

HCW GENERATION, HANDLING, SEGREGATION, TRANSPORTATION AND STORAGE

7. What is the type of waste generated in your department?

Infectious waste for example blood, body fluids	
Anatomical waste for example human tissue, body parts, foetus	
Sharps waste for example needles, scalpels, blades, broken glass	
Pharmaceutical waste for example outdated medications, vaccines, contaminated pharmaceutical products	
Chemical waste for example reagents , solvents	
General waste for example paper, plastics, bottles, cartons	

Radioactive waste for example solid , liquid and gaseous waste contaminated with radionuclides	
Others(specify)	

PLEASE TICK WHAT YOU FEEL IS THE MOST IMPORTANT

8. HCW is segregated in your department.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9. Who separates HCW in your department?

Nurses	
Doctors	
Pharmacists	
Pharmacist assistants	
Cleaners	
Kitchen staff	
laundry staff	
Porters	
Others(specify)	

10. Do you have any colour coding system for sorting HCW in your hospital

Yes	
No	
Do not know	

11. Are there any instructive posters for HCW segregation in your department?

Yes	
No	
Do not know	

12. Which of the following is used for infectious HCW in your hospital?

red plastic bag	
yellow plastic bag	
brown plastic bag	
black plastic bag	
Others(specify)	

13. Which of the following is used for general HCW in your hospital?

red plastic bag	
yellow plastic bag	
brown plastic bag	
black plastic bag	
Others(specify)	

14. Which of the following is used for pharmaceutical HCW in your hospital?

red plastic bag	
yellow plastic bag	
brown plastic bag	
black plastic bag	
Others(specify)	

15. Which of the following is used for sharps HCW in your hospital?

red plastic bag	
yellow plastic bag	
brown plastic bag	
black plastic bag	
yellow box	
Others(specify)	

16. HCW bags in your hospital are subject to tear.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

17. Staff wear protective clothing when handling your HCW in your hospital.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

18. Which type of protective clothing does staff wear when handling HCW in your hospital?

Gloves	
Aprons	
Face masks	
Goggles	
Gum boots	
Others(specify)	

ON-SITE TRANSPORTATION

19. What is the mode of transportation of HCW within the hospital**?**

wheelie bins	
wheeled trollies	
Carts	
Others(specify)	

20. How often is HCW collected from your department to the waste storage area?

once a day	
twice per day	
per rising need	
Other(specify)	

21. Who collects HCW from your department to temporary storage area?

Nurses	
Doctors	
Pharmacists	
Pharmacist assistants	
Cleaners	
Kitchen staff	
laundry staff	
Porters	
Others(specify)	

HCW STORAGE

22. Temporary HCW storage area sufficient in the hospital.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

23. Is the temporary storage area for HCW in your hospital lockable?

Yes	
No	
Do not know	

24. How long does the hospital temporarily store HCW before it is transported to the treatment facility?

24 hours	
48 hours	
72 hours	
Others(specify)	

25. Is HCW weighed in your hospital?

Yes	
No	
Do not know	

HCW OFFSITE TRANSPORTATION

26. Who collects HCW from your hospital temporary storage area to the treatment facility?

Private contractors transport	
Hospital transport	
Other(specify)	

27. How often is the HCW collected from your hospital to the treatment facility?

Daily	
Once a week	
Once per fortnight	
Once a month	
Other(specify)	

SECTION C: HCW MANAGEMENT AND TRAINING

28. Have you ever received any training in HCW management?

Yes	
No	
Do not know	

If yes, how long was the training period?

One day	
Less than a week	
One week	
More than a week	
Other(specify)	

29. Are new employees given training on waste handling and management when they commence their duties?

Yes	
No	
Do not know	

30. Health care waste is being managed effectively in your hospital.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

31. HCW in your hospital is being handled according to the HCW policy of Namibia.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

32. Are you aware of any document outlining the HCW management policy at your hospital?

Yes	
No	
Do not know	

33. Does your hospital have a HCW management team?

Yes	
No	
Do not know	

34. Does your hospital keep records of HCW generated?

Yes	
No	
Do not know	

35. How is HCW from your hospital treated?

incineration	
steam autoclaving	
microwaving	
Others(specify)	

SECTION D. IMPACT OF HCW

36. What are the risks of HCW to human health?

sharps injury	
hepatitis	
HIV	
Others(specify)	

37. What are the risks of HCW to the environment?

air pollution	
ground water pollution	
Others(specify)	

Thank you.

ANNEXURE H

Observation checklist

HOSPITAL: ……

DEPARTMENT: ……

DATE: ……

CRITERIA	YES	NO	N/A	COMMENT
Infectious and non-infectious waste separated				
Infectious and non -infectious waste bags not more than ¾ full				
Waste receptacles lined with appropriate recommended bag				
Marking or symbol attached to different bags for example biohazard , cytotoxic				
Sharps waste container not more than ¾ full				
Only sharps are placed in the sharps waste container				
HCW handlers wear personal protective equipment				
Availability of onsite transportation for example wheelie bins, wheeled trollies and carts				
Availability of set routes for onsite transportation				
Availability of a temporary storage area				
Is the temporary HCW storage area marked with a biohazard sign				
Is the temporary HCW storage area clean				
Is the temporary HCW storage area far from patient area				
Is the temporary HCW storage area lockable				
Is the temporary HCW storage area protected from the effects of weather condition for example rain, sun, floods				
Availability of a water supply at the HCW temporary storage area				
Availability of a scale to quantify waste				

CRITERIA	YES	NO	N/A	COMMENT
Is there adequate ventilation and lighting of the HCW temporary storage unit				
Is there a cold storage facility to store human waste				
Availability of a HCW monitoring tool				
Availability of HCW registers for vehicles which transport waste to treatment site				
Are bags labelled before being transported to treatment site				
Availability of a manifest document from point of health care waste collection to treatment site				
Availability of licenced designated vehicles for transportation of HCW				
Availability of hospital HCW policy				
Availability of national policy guidelines on HCW management				
Proper routing followed by the transporter of waste to treatment site.				
Availability of spill kits				
Proof of vaccination of waste handlers				
Proof of training given to waste handlers				

ANNEXURE I

Letter from the statistician

Compstats Technologies cc

2 Dora Street, New Doornfontein, Johannesburg
Website: www.compstats.co.za

Fax: 086 654 3153
Cell: +27 83 422 1238
+27 81 748 7524
Emails: info@compstats.co.za
elisha@compstats.co.za
elishacompstats@gmail.com

13 December 2016

Ref: STATS016

Department of Health Studies
Theo van Wyk 7-154
PO Box 392
UNISA
0003

Attn: Prof P.R. Risenga

MASTERS OF ARTS IN NURSING SCIENCE: MUSHIPE MEMORY

This letter serves to confirm that I, **Elisha Meja**, *research statistician and network systems integrator for Compstats Technologies*, helped Memory Mushipe with the following statistical work for her research;

1. Sampling design
2. Data capturing and
3. Statistical data analysis

Data capturing, coding, cleaning and analysis was done using Microsoft Excel (for Office 2013) and SPSS version 23.0 softwares.

The sampling methods used in this study were purposive and stratified random sampling. Data cleaning was done through performing a series of trial runs (using SPSS version 23.0) of analysis checking the entries if they corresponded with items and sub-items in the measuring instrument. Where discrepancies were observed, original questionnaires were consulted and corrections made prior to actual and conclusive analysis.

Page 1 of 2

Compstats Technologies cc

2 Dora Street, New Doornfontein, Johannesburg
Website: www.compstats.co.za

Fax: 086 654 3153
Cell: +27 83 422 1238
+27 81 748 7524
Emails: info@compstats.co.za
elisha@compstats.co.za
elishacompstats@gmail.com

Validity (Pearson's product moment correlations) and reliability (Cronbach's Alpha) analysis was done on pilot study to assess the validity of the data collection instrument and to assess whether items in this instrument (questionnaire) would measure the same construct that they are purposed to measure.

Actual survey data were analysed using exploratory (cross tabulations, bar and pie charts), descriptive and nonparametric inferential statistics (Pearson's Chi-Square tests).

I trust you find this in order

Sincerely

E. MEJA
(Research Statistician)

ANNEXURE J

Letter from the language editor

ACET Consultancy
Anenyasha Communication, Editing and Training
Box 50453 Bachbrecht, Windhoek, Namibia
Cell: +264 814218613
Email: mlambons@yahoo.co.uk / nelsonmlambo@icloud.com

18 December 2016

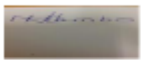
To whom it may concern

LANGUAGE EDITING – MEMORY MUSHIPE

This letter serves to confirm that a MASTER OF ARTS in the subject NURSING SCIENCE by Memory Mushipe entitled AN INVESTIGATION OF THE HEALTHCARE WASTE MANAGEMENT PRACTICES AT A PUBLIC AND PRIVATE HOSPITAL IN KHOMAS REGION, NAMIBIA was submitted to me for language editing.

The thesis was professionally edited and track changes and suggestions were made in the document, which if followed by Memory Mushipe, will result in a thesis with a high standard of English.

Yours faithfully



Dr N. Mlambo

PhD in English
M.A. in Intercultural Communication – i.p.
M.A. in English
B. A. Special Honours in English – First class
B. A. English & Linguistics