



**ASSESSING INFECTION CONTROL KNOWLEDGE AND  
COMPLIANCE IN THEATRE AT A PRIVATE HOSPITAL IN  
KWAZULU-NATAL, SOUTH AFRICA**

**Submitted in fulfilment of the Requirements of the degree of**

**Master of Health Science in the  
Faculty of Health Sciences at the  
Durban University of Technology**

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## **AUTHORS DECLARATION**

I hereby confirm that the work submitted in this dissertation is composed by myself, and has not been submitted for any other degree or diploma at any other university or other higher education institute, except where appropriate credit has been given to the work of others.

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## **Dedication**

This master's dissertation is dedicated to my husband Lesley Naidoo and my two sons, Ocean and Storm for their continued support throughout my study, for patience and their love in allowing me the time to complete this work.

To my late mum and dad, for instilling in me good principles of commitment and dedication which is so necessary in attaining your goals in research.

Finally, I could not have achieved this without God, for all things are possible with Christ who strengthens me.

## **ABSTRACT**

Infections acquired in a hospital (HAI) often referred to as nosocomial infections are related with increasing morbidity and death among patients that are hospitalised and are predisposed to an elevated risk of infection by health workers (HCWs). The need to maintain an effective infection prevention and control program is therefore essential for quality health care. This study sought to assess the knowledge and compliance of infection control practices of Cardiovascular Perfusionists in theatre at a private healthcare facility in KwaZulu-Natal (KZN) in the city of Durban.

A qualitative, research design was used to explore the knowledge and compliance of infection control practices of Cardiovascular Perfusionists by conducting online semi structured interviews. The interviews were conducted online due to the current pandemic of COVID-19, where much consideration was given to social distancing and modes of virus transmission. Duration of the interviews lasted no more than 20 minutes.

Prior to conducting the main study, a pilot study was pursued in order to ensure that the interview questions were relevant and that the participants had clear engagement with the questions and no modification nor questions were added to the interview guide. The researcher found that the actual description of the professions differed in the procedures carried out, however, the theatre environment is the same, and only a few questions pertaining to the difference in practice of the participants had to be slightly rephrased in order to be more applicable to the main study.

The study was conducted by means of a purposive sample of Cardiovascular Perfusionists. The interviews conducted were limited to only those that practice in the private sector. Participants were chosen based on their ability to provide the necessary information. The interviews were transcribed and then coded by a statistician. The rationale for selecting this strategy was that the researcher was seeking knowledge about the factors that influence the knowledge and compliance of Cardiovascular Perfusionists in the private sector regarding infection prevention and

control techniques. Subsequently, these participants would be therefore able to contribute valuable information.

The major themes which emerged were namely, infection control and prevention, knowledge of healthcare associated infections, awareness of healthcare acquired infections, cardiovascular perfusionists procedures and precautions followed in cardiovascular surgery.

The study found that there is a need for Clinical Technologist specialising in Cardiovascular Perfusion to undergo training in infection control and prevention practices at the higher education and training level. Subsequently, the study reveals that Cardiovascular Perfusionists have a good overall understanding of pathogens and the implications thereof. The study also notes that there is considerable compliance to infection control practices in theatre irrespective of the knowledge pertaining to infection control and prevention policies.

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## List of Abbreviations

CP	Cardiovascular Perfusionist
CDC	Centers for Disease and Control
HAI	Hospital Acquired Infection
HCAI	Healthcare Acquired Infections
SSI	Surgical Site Infection
HIC	High Income Country
OT	Operating Theatre
NDOH	National Department of Health
CDC	Centre for disease and Control
WHO	World Health Organisation

## **CHAPTER ONE**

### **OVERVIEW OF THE RESEARCH STUDY**

#### **1.1 Introduction**

Cardiovascular Perfusion is a category of the profession Clinical Technology. These are specialists that operate a heart lung machine as well as play a supportive role during coronary artery bypass and related procedures in theatre and form part of the surgical team. The purpose of this study was to assess if these professionals are knowledgeable and compliant to infection prevention and control practices in theatre. According to the National Department of Health (NDOH), infection and prevention programmes are essential in order to prevent healthcare associated infections (HCAI) or antimicrobial resistance (NDOH, 2020). Because the Cardiovascular Perfusionist (CP) is present in theatre for the full duration of any cardiac and other blood salvaging related procedures, it is essential to understand their contribution and implications to infection control and prevention practices.

There is currently no study that shows if a CP practices their knowledge and compliance to infection control policies or contributes to hospital acquired infections or antimicrobial resistance in surgical site or related procedures within the operating room. According to the International Society for infectious diseases, in patients that undergo surgical procedures, approximately two to five percent experience surgical site infections (SSIs) (Roy, 2018). In poor and middle-income nations, SSIs are the most common cause of health-related infection. SSIs are the second most prevalent form of adverse event in high-income countries (HICs) of hospitalized patients but are surpassed by medicines mistakes. Since SSIs are usually acquired during the operation while the incision is open, attention needs to be given to certain infection control practices in the operating room (Roy, 2018).

### **1.1.1 Background and rationale**

Infection prevention and control practices aim at reducing hospital-acquired infection. Such infections are acquired during the course of hospital stay and not at the time of admission to a hospital or any health-care facility (Nejad et al., 2011). Another frequently used term for HCAI is nosocomial infections and it has been estimated that the risk of such infections was found to be approximately 20 times higher in developing countries than in developed countries (WHO, 2018).

Due to the dynamics involved in patient care and the multidisciplinary healthcare team, the hospital environment has become home to organisms that are found to be extremely virulent, namely: *Staphylococcus aureus*, *Streptococcus pyogenic*, *Escherichia coli*, *Pseudomonas Aeruginosa* and Hepatitis viruses (Sydnor & Perl, 2020). Such organisms cause diseases that range from skin infections to conditions that can be life-threatening to both the patients, and healthcare professionals alike (Sydnor & Perl, 2020).

The process pertaining to surgical intervention and the association to Cardiovascular Perfusionists commences in theatres and possibly concludes in, intensive care units, and therefore, may be associated with cross infections during procedures ranging from insertion of central venous lines, urinary catheter insertions, surgical site infections to ventilator associated pneumonia (Khan et al., 2015). Due to the complex nature of healthcare acquired infections, such infections are closely related to high hospital expenditure and is a leading cause of death (WHO, 2015).

The WHO Infection and Prevention and Control in Healthcare Effort, according to Longenecker and Longenecker (2014), aims to help hospitals reduce the spread of infections linked with health care by aiding with the assessment, planning, implementation and evaluation of national infection control policies (Longenecker & Longenecker, 2014). The ultimate goal is to aid institutions in promoting high-quality healthcare that is safe for patients, healthcare professionals, people in the healthcare setting, and the environment, while also being cost-effective.

It is therefore, essential to identify gaps within the healthcare setting in order to minimize the rate of infection in patients, reduce the burden of expenditure and providing high standards of healthcare delivery. Such gaps can be linked to the levels

of knowledge and compliance in healthcare workers with a particular focus on Cardiovascular Perfusionists that form part of the surgical team. Chisanga (Chisanga, 2017), consequently states that objectives of infection prevention and control protocols are necessary to protect the public who are vulnerable to illness in the healthcare sector (Chisanga, 2017; Kalenic, 2012).

According to the WHO (2015) preventing HCAs is becoming considerably challenging on a global scale, and therefore, identifies it as a significantly critical matter due to the high numbers of patients becoming infected while being cared for in healthcare facilities. To further elaborate on the importance of infection prevention, Loveday (2020), points out that IPC practices were initially advocated for by the legendary, Florence Nightingale in 1854 (Loveday, 2020). She identified that there exists a relationship between diseases causing death and the poor conditions of the environment. Florence Nightingale played a significant role in establishing that each patient requires clean equipment and wound dressings, antimicrobial resistant isolation, good ventilation and waste management. Her determination in infection prevention, led to education and training and development of infection prevention and control policies (Loveday, 2020).

## **1.2 Theatre Etiquette**

Theatres in hospitals are a very sensitive and complex environment that requires strict hygiene standards to be maintained. For a model of excellence in instructional strategies to be maintained at all times, it is necessary to adhere to a strict code of behaviour (Lande-Marghade, 2018). There is some margin for error, and significant accidents are able to occur if the quality of care is not maintained at all times. The fundamental concept of having particular etiquettes and mannerisms is, therefore, vital for quality and safety in patient and healthcare workers, as well as for achieving a positive end (Lande-Marghade, 2018).

### **1.2.1 Theatre Wear**

The general rule to enter any theatre premises is to ensure that you are dressed in the correct attire. This means that you have to change from your general attire into theatre scrubs. Surgical scrubs are a crucial component of a healthcare provider's uniform, and they were first developed in order to protect the cleanliness of the operating room



environment, among other reasons (Shahzad et al., 2021). However, data indicating that surgical scrubs can be a source of germ transmission began to emerge in the early 1900s, and the emphasis on using them exclusively in sterile areas began to disappear (Shahzad et al., 2021).

According to the Centres of Disease and Control as discussed by Mangram (1999), in the attempt to prevent surgical site infections, surgical attire should include, wearing a surgical mask and fully covering the hair with a surgical cap or hood (Mangram et al., 1999).

### **1.2.2 Hand Hygiene**

In an effort to reduce the burden of health-care-associated infections, the World Health Organization (WHO) created the inaugural Global Patient Safety Challenge in 2005 and the '5 moments of hand hygiene' in 2009, respectively (Chou, Achan, & Ramachandran, 2012). This concept of hand hygiene has been embraced by many hospitals in the United Kingdom, which encourages health care staff to sanitize their hands at five separate stages of patient care, including admission, transfer, and discharge (Ramachandran et al., 2012).

Guidelines created by the Centres of Disease and Control (CDC) postulate that hand washing is considered as one of the most significant measures in the prevention of healthcare acquired infections (Patel et al., 2016). The CDC further indicates that it is essential to hand wash with antimicrobial agents when coming into contact with patients, and following the performance of clinical procedures (Patel et al., 2016).

Patel et al., (2016), posits that in South Africa, healthcare workers compliance to hand hygiene techniques is generally poor, and is seen as a contributing factor to an estimated 10-25% of HCAI in patients (Patel et al., 2016).

### **1.2.3 Aseptic Technique**

Aseptic technique is a collection of precise techniques and processes that are carried out under carefully controlled settings with the purpose of reducing contamination by microorganisms to the greatest extent possible (Hauswirth & Sherk, 2019). To achieve this, it is necessary to use aseptic techniques to safeguard patients from infection and

to reduce the spread of microorganisms. Frequent source of transmission of pathogens are through, environmental, personal, or equipment contact (Hauswirth & Sherk, 2019).

Surgical site infections were found to be the third most prevalent nosocomial (hospital-acquired) infection, and they are accountable for greater expenditures to both the patient and the hospital as a result of prolonged hospitalizations. In order to reduce the morbidity and mortality associated with surgical infections, aseptic technique must be used during the procedure (Osman, 2000; Hauswirth & Sherk, 2019).

#### **1.2.4 Preoperative Aseptic Practices**

Once sterile gloves have been applied, it is crucial to avoid touching nonsterile materials; the hands may be firmly intertwined to prevent unintended contamination of the gloves. A break in the glove or contact with a non-sterile surface necessitates the removing of the glove and the application of fresh gloves immediately (Moran & Heuertz, 2017).

Creating sterile surgical fields using drapes in the operating room or for other invasive operations also helps to preserve asepsis in these environments. In order to define sterile zones, sterile drapes which are sterilized cloths, are draped over the patient or the surrounding field. It is important to open drapes or packaged kits of equipment carefully so that the contents do not come into contact with non-sterile items or surroundings (Hauswirth & Sherk, 2019).

Equipment and devices, too, require careful consideration. Sterilization of medical equipment, such as surgical tools, can be accomplished using chemical treatment, gas, or high temperatures. Ensure that sterile packages are dry and unbroken, and look for sterility markers like expiration dates or tape which changes colour when it is sterile (Hauswirth & Sherk, 2019).

#### **1.2.5 Infection prevention and control policy**

As defined by the National Infection and Prevention and Control Strategy (Department of Health (NDOH, 2020), infection prevention and control refers to the practices,

protocols, and procedures that are used in health care facilities to prevent and control infections and the transmission of infections.

### **1.3 Research Problem**

The researcher is a Cardiovascular Perfusionist in private practice in KwaZulu-Natal in Durban Central and has observed there is an increased pressure on CPs, and the implications in possible post-operative infections in the Intensive Care Units. In addition, it was observed that the hospital's infection prevention and control development programs, such as hand washing procedures and the wearing of protective equipment required for infection prevention and control, were not consistently implemented among the other healthcare workers within the theatre environment.

Patel et al., (2016), postulates that hand hygiene compliance of nurses are higher than that of doctors. This arises from the ideology that the doctor is always correct, however such a strategy of thought can be used to the benefit of hand hygiene programs, and it can be particularly effective when combined with education on hospital-acquired illness rates and antibiotic stewardship to provide a more complete approach to patient management (Patel et al., 2016). Patel et al., (2016) further suggests that implementing visual reminders, constant observation and availability of policies and resources, plays a critical role in infection control compliance (Patel et al., 2016).

Subsequently, the researcher identified that the hospital that is frequented by the participants in this study are not given access to infection control prevention policies. These observations created the need to assess if Cardiovascular Perfusionists indeed are knowledgeable and compliant to infection prevention control practices in theatre.

### **1.4 Research Question**

Taking into account the above narrative of the background, rationale and problem statement, the following research questions deem applicable:

- Are Cardiovascular Perfusionists knowledgeable of infection control practices in theatre

- Are Cardiovascular Perfusionists compliant to infection control practices and policies in theatre

## **1.5 Research method**

For the purposes of developing new knowledge and/or improving one's understanding of certain situations, research methods can be characterized as a procedure or a set of plans for carrying out specific parts of a study, which may involve the collecting of information and data. Among the research methodologies for this study are the population, sample and sampling method, data collecting and analysis, reliability and ethical principles, and the trustworthiness of the results (Creswell, 2014:247).

### **1.5.1 Pilot Study**

Pilot studies are frequented with the use of a quantitative methodology to evaluate a certain research instrument or method. The significance of pilot work appears to have been extended to qualitative inquiry, where it is carried out as a preliminary to the big study (Majid et al., 2017). Pilot studies are effective processes for preparing for a larger-scale investigation, irrespective of the paradigm being used (Majid et al., 2017).

The purpose of the pilot study in this paper, was to determine whether the questions were appropriate and to provide the researcher with some preliminary ideas about the feasibility of the research. The experience gained from conducting in-depth, semi structured interviews as well as the ability to establish rapport with the participants were equally beneficial to the researcher. It is important to note that the pilot study benefited the researcher in acquiring the techniques of interviewing and comprehending the communication process.

Subsequently, in this research study, it was necessary to address potential practical problems that might arise, as well as to trial the questions. Potential problems that were considered was scheduling an online meeting due the constraints of the global pandemic and the need for social distancing, and , taking into account issues of data usage and connectivity as well as participants availability.

### **1.5.3 Population**

The term "population" refers to an aggregate or totality of all participants who are of relevant to the research and who meet the conditions for participation in the research project (Lopez & Whitehead, 2013). The participants in this study are cardiovascular perfusionists who work at a private hospital in the KwaZulu-Natal province of South Africa.

### **1.5.4 Sampling and sampling method**

Purposive sampling is a technique commonly used in qualitative research in order to select a great deal of information to make the most efficient use of limited resources (Lopez & Whitehead, 2013). Cardiovascular Perfusion training is limited in South Africa due to the critical nature of the occupation and the lack of knowledge of the profession. According to Linda Mongero (2016), these are some of the reasons for the decline in the number of perfusionists being trained (Mongero, 2016). Therefore, a purposive sampling technique was used as it was essential that the participants chosen were all graduated with a Bachelor's Degree and had the years of knowledge and experience in order to participate. Additionally, the participants are those who work in private hospitals.

### **1.5.5 Data Collection**

Various methods of data collection methods exist, namely, direct and indirect data collection. Direct data collection requires the use of interviews, observation, diarising the interview session or even an open ended questionnaire (Lopez & Whitehead, 2013). The method of direct data collection by interviews, was exercised in this study. Firstly, letters of information pertaining to the study was sent to all participants as well as a letter of informed consent had been obtained prior to the commencing of the interviews. Data was gathered through individual semi-structured online interviews with Cardiovascular Perfusionists, as the researcher wished to obtain personal, unbiased input from them.

Data was transcribed verbatim, and then sent to a statistician to develop codes from suitable themes and sub themes, arising from the interviews. Details are further described in Chapter 3.

### **1.5.6 Data Analysis**

With qualitative research, the data acquired are typically text based. According to Wong (2008) the process of data analysis can be defined as a process that simplifies, summarizes, and gives meaning to data that has been acquired (Wong, 2008). It is an extensive exercise exploring meanings, experiences and thoughts, which pertain to the research being conducted.

The process of interpreting data obtained from a qualitative study, entails coding or categorizing the information. Essentially, it involves making sense of massive volumes of data by simplifying the volume of the raw information, then recognizing relevant patterns or themes, finally extracting insights from data, and ultimately constructing a coherent collection of evidence.

The themes are identified by the use of repetitive words from participants, commonly used terms, or key words, or even comparing or contrasting the text acquired (Ryan & Bernard, 1998).

The most crucial stage in the qualitative process of data analysis is coding or categorizing the data. Coding and data analysis are not considered synonymous, despite the fact that coding is an important part of the qualitative data analysis process. Coding is simply the process of dividing a large amount of raw information or data and categorizing it.

Similarly, data obtained from the interviews in this study, were transcribed and then sent to a statistician for coding derived from the themes and sub- themes. Details are further discussed in Chapter 3.

### **1.5.7 Ensuring trustworthiness**

There are no exceptions when it comes to quality attributes for qualitative approach, which includes the 'big three' techniques. The quality criteria employed in quantitative research, such as internal validity, generalizability, dependability, and objectivity, are not appropriate for judging the quality of qualitative research, as they are not applicable in qualitative research. The term "trustworthiness" is used by qualitative researchers to refer to the question "Can the findings be relied upon?" There are many

different definitions and requirements for trustworthiness, but the most well-known are the credibility, transferability, dependability, and confirmability criteria, which were articulated by Lincoln and Guba (Korstjens & Moser, 2018)

#### **1.5.7.1 Credibility**

It is the degree of confidence that may be expressed in the validity of the research outcomes. The credibility of the research findings is determined by whether or not the information derived from the participants' source information is believable and whether or not the conclusions represent a correct interpretation of the participants' original viewpoints (Korstjens & Moser, 2018). In this study, credibility is depicted by the use of quotes during participant dialogue during the interviews.

#### **1.5.7.2 Transferability**

Based on reading, the extent of the findings of qualitative research may be applied to various contexts or settings with different respondent measurements. Through extensive explanation, the researcher aids in the decision-making process of a potential user about transferability (Korstjens & Moser, 2018). In this regard, it should be noted that the studies conducted were in reality relevant to perfusionists who practice at a specific private hospital in KwaZulu-Natal Central, and that the opinions expressed may not necessarily mirror those of perfusionists in other parts of the country.

#### **1.5.7.3 Dependability**

Dependability refers to the consistency of findings over a period of time. Dependability is defined as the ability of participants to evaluate the research results, interpretation, and suggestions of a study in such a way that they are all representing the data collected from the participants in that study (Korstjens & Moser, 2018). This was the case in the research under consideration since the questions about knowledge and compliance with infection prevention and control measures were not appropriately addressed at the outset of the investigation. These challenges surfaced from the data collected during the pilot study and were subsequently included in the interview schedules for the main research.

#### **1.5.7.4 Confirmability**

Pertains to the extent to which the conclusions of the research study could be confirmed by other experts is shown. Confirmability is focused on establishing that the data and interpretation of the data are not only depictions of the inquirer's imagination, but are in fact obtained directly from the data and evidence (Korstjens & Moser, 2018). In this study, consultation with a statistician was, therefore, critical.

#### **1.6 Ethical Considerations**

Ethical approval was acquired from the Institute of Research and Ethics Committee of the Durban University of Technology (ethics clearance number IREC 105/20). Consent was obtained from each participant and no personal details were obtained on the consent. All participants were assigned pseudo names for the process of thematic analysis.

#### **1.7 Chapter Outline**

Chapter 1: Introduction and overview of the study

Chapter one presents the introduction and an overview of the study, emphasising the motivation for the investigation. It envelopes a brief outline of the aim of the study, an explanation of the research problem.

Chapter 2 : Literature Review

Chapter two outlines the literature review which comprehensively discusses the knowledge and compliance of health care workers, as well as the suggestive evidence and sources leading to poor infection control and hospital acquired infections in South Africa and in the world.

Chapter 3 : Research Methodology

Chapter three outlines the research method used to establish the knowledge and compliance of Cardiovascular perfusionists to infection control and prevention practices in theatre. The chapter covers the research design, the setting and method of data collection, the study population and sampling procedure, a detailed data analysis and ethical considerations.



#### Chapter 4 : Results and Discussion

Chapter four discusses the results of the study by evaluating the answers retrieved from the questions.

#### Chapter 5 : Recommendations and conclusions

Chapter five articulates the possible recommendations that can be suggested from the results obtained in this study. This chapter collectively encloses the study and poses the opportunities for future research.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1. Introduction**

The components of this chapter will review healthcare acquired infections, types of infections and pathogens. The literature review comprehensively discusses the knowledge and compliance of health care workers, as well as the suggestive evidence and sources leading to poor infection control and hospital acquired infections in South Africa and in the world. This literature review will identify the importance of knowledge in infection prevention and control practices and the need to comply to IPC policies in theatre.

Currently, literature identifying infection prevention and control practices, knowledge and compliance pertaining to Cardiovascular perfusionists and the Cardiac Operating Theatre is limited.

##### **2..1.1 Cardiac Surgery Theatre**

The theatre environment is based on the assumption that all such areas are theoretically sterile, with minimum exposure to the external environment. It is then essential that all personnel that transit this area are required to maintain infection prevention and control policies (Lande-Marghade, 2018).

##### **2.1.2 Cardiovascular Perfusionists**

Cardiovascular Perfusionists(CPs) or Perfusionists are vital members of the operating room team and are required during open-heart surgery or any other medical procedure in which it is necessary to artificially support or replace a patient's circulatory or respiratory function (Clinic, 2015). Cardiovascular perfusionists are a part of the surgical support team and are necessary for operating extracorporeal circulation equipment, such as the heart-lung machine, the intra -aortic balloon pump, autologous blood salvaging devices and also extend to monitoring the patient's vital signs (Clinic, 2015). The perfusionists role expands beyond that of cardiac surgery, into neurology, gynaecological procedures, orthopaedic as well as vascular and general surgery.

Perfusion entails the movement of biological fluids, such as blood, from one organ or tissue to another through the circulatory or lymphatic systems, by use of an extensive circuit set up (Clinic, 2015). Since the heart is primarily responsible for regulating blood fluid through the body, it is apparent that when a patient undergoes a procedure that causes the heart's usual function to be interrupted, a cardiovascular perfusionist is called in to temporarily take over the function of the heart and lung. In addition to monitoring vital signs, they also pick the most appropriate equipment and strategy for maintaining normal blood flow, body temperature, and other respiratory processes in the patient (Clinic, 2015).

The work environment of Cardiovascular Perfusionists falls typically within the operating theatre but can extend to the intensive care units as well as trauma. Therefore, they may find themselves spending much of their day in the theatre environment and are therefore critically involved in infection control practices (Clinic, 2015).

### **2.1.3 Equipment operated by Cardiovascular Perfusionists:**

- Heart Lung Machine (Figure 2.)
- Cell Salvaging Device or Cell Saver (Figure 3.)
- ECMO(Extra Corporeal Membrane Oxygenation (Figure 4.)
- Intra Aortic Balloon Pump (Figure 5.)

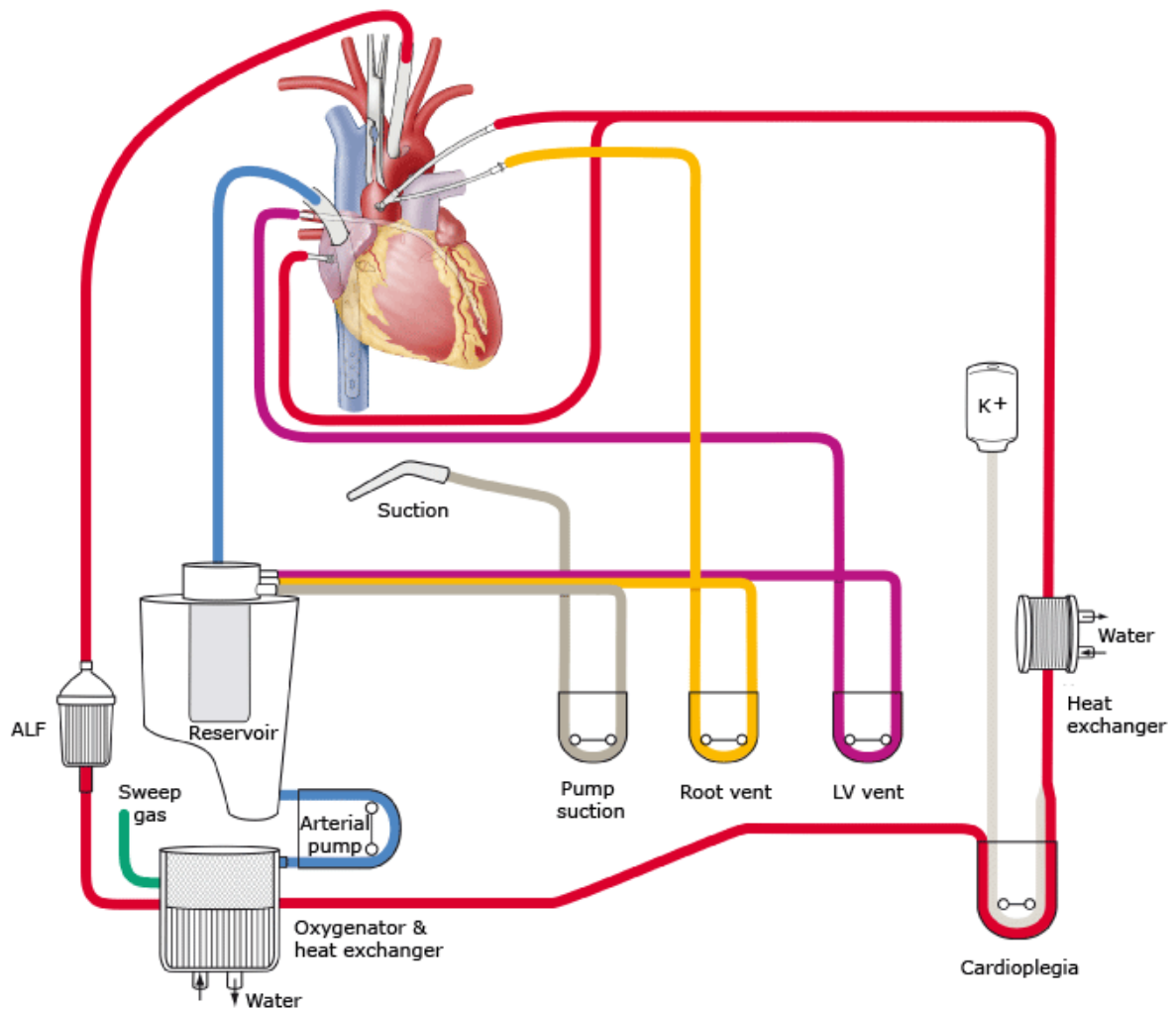


Figure 1. Diagram of Cardiopulmonary Bypass Circuit (CPBC) (Kramer et al., 2018)

1. Blue line- Shows the path of the venous drainage through the roller pumps on the Heart Lung Machine
2. Red line- Shows the path of the blood from the reservoir to the Oxygenator where heat exchange occurs(Heater Cooler), through the arterial filter and back to the aorta
3. Grey Line- Show the Cardiotomy suction for suction of blood from the pericardial cavity

4. Yellow Line- show the path of blood from the heart, to ensure that the heart is vented.
5. Left Ventricular Vent- Shows the venting of blood from the left ventricle
6. C- Represents the path of the oxygenated blood through the Cardioplegia Pump

## **2.2 Cardiopulmonary Bypass Procedure**

The Cardiopulmonary Bypass procedure described below is the basic method used by perfusionists that were trained at the Durban University of Technology and Inkosi Albert Luthuli Central Hospital. The technique described has been passed down as clinical training from the predecessors of the profession in KZN.

Cardiac surgery, otherwise known as cardiopulmonary bypass, involves the diversion of blood from the heart via the use of a venous cannula and then returned to the body via an aortic cannula. These cannulas are connected to an extensive network of extracorporeal tubing which in turn is connected to a venous reservoir at the heart lung machine (Sarkar & Prabhu, 2017).

The aim of this set up is to ensure that the heart becomes arrested and that the operating field is bloodless, so that the surgeon is able to have a comprehensive view of the heart (Sarkar & Prabhu, 2017). The mechanism of action is, that the blood is pumped from the heart to the venous reservoir which houses the blood in a sterile manner. It is through here that an exchange of gases occur (oxygen and carbon dioxide). Blood is then returned to the aorta, which transports the blood to the rest of the body. This occurs as a closed circuit with the intention of bypassing the heart itself. In order to arrest the heart, a cardioplegic solution containing high doses of potassium is intermittently used in small amounts (Sarkar & Prabhu, 2017).

This process requires that the body enter into a hypothermic state by means of a heater cooler, in order to reduce the overall metabolic requirements (Figure.1 CPBC).

Heparin plays a critical role in maintaining the bypass circuit anticoagulated. Regular heparin checks are necessary, and is done by means of an activated clotting time test.

The bypass circuit requires the ACT to be maintain at about 400sec in order to prevent any blood emboli from occurring or causing the oxygenator to become clotted (Sarkar & Prabhu, 2017).

### **2.2.1 Heart Lung Machine(HLM)**

One of the main components of the heart lung machine (Figure 2.) is a console base that stores all of its electronic components and battery packs (Shaw, 2008).

A typical HLM would have four or five roller pumps. At the roller pumps blood is propelled through the tubing by means of the rolling action. Michael DeBakey created the first roller pump for a heart-lung machine, which had two unconventionally mounted revolving rollers which pressed a tube within a semi-circular loop on the inside of a cylinder wall. Blood flow is determined by the tubing's rotational frequency and the tubing's inner diameter (Shaw, 2008). The heart lung machines, are also equipped with electronic safety mechanisms, like air bubble detectors, sensors to measure flow rate, pressure sensors and temperature sensors (Shaw, 2008).

In order to carry out a successful surgical surgery, a number of external devices are required. For example, blood can be heated or cooled using a machine that supplies temperature-controlled water to a blood heat exchanger inside the oxygenator. Another critical component of the HLM is the gas blender. This device is used to ensure that the patients' blood can be oxygenated as well as assist in the removal of carbon dioxide (Shaw, 2008).

For adequate respiration a blood gas analyser that analyses the concentration of oxygen and carbon dioxide in the bloodstream is required. It is used to monitor the patient's chemical composition and offer input on the body's metabolic requirements. Some modern HLMs use chemical sensors in the blood circuit to constantly monitor the data, which are subsequently shown on the HLM's central monitor (Shaw, 2008).

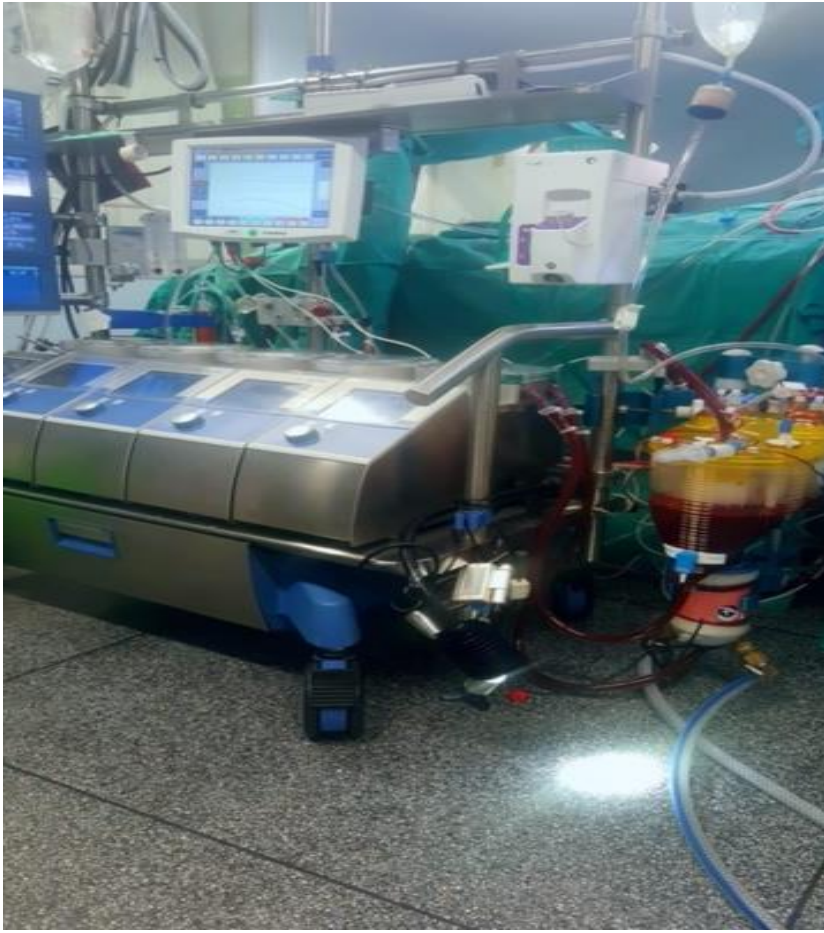


Figure 2. The heart lung machine showing the extensive set up of the bypass circuit and venous reservoir.

Once the patient has been connected with the bypass circuit to the heart lung machine, cardiopulmonary bypass may commence. The process occurs with a closed circuit and it can be argued that the environment in which blood travels would therefore, be free from contracting any form of a pathogen (Kramer et al., 2018), however, this can be argued with prior literature which concludes that the stopcock is a source of recurring contamination into the blood stream. (Tre'panier et al., 1990).

### 2.2.2 Cell Saver Device

The cell saver device is used to remove impurities such as cells, lipids, bone chips and potassium that has spilled from haemolysis, and ensure that packed red blood cells are returned to the patient. By use of this machine the possibility of the patient receiving foreign infections or mismatched blood types is eliminated. The surgical field is suctioned and the blood is collected in a reservoir. In order to keep the blood flowing, an anticoagulant is given to the blood that has been shed (Shaw, 2008). A centrifuge is used to separate red blood cells from waste materials. Red blood cells are held in place by the centrifuge's force, which is generated by the spinning motion. Waste bags receive the less dense white blood cells, platelets, plasma, and anticoagulant.



Figure 3. Cell Saver Device



Once the waste products are removed, the red blood cells become suspended in saline during the final washing phase. Aside from suctioning blood from the surgical site, swabs can also contain blood that can be reused. Due to this reason, cell salvage devices have become an essential feature of blood management and conservation programs in hospitals (Shaw, 2008).

### 2.2.3 ECMO Machine

A pump, a membrane oxygenator, a blood warmer, and an arterial filter constitute the Extra Corporeal Membrane Oxygenation (ECMO) machine (Figure 4.). Excess oxygen-poor blood from the right ventricle is pumped into an oxygenator, where it is exchanged for CO<sub>2</sub>, water vapor, or both. Before returning to the patient, oxygen-rich blood which is heated and filtered (Shaw, 2008).

If ECMO is used to provide respiratory support, the arterialized blood is typically returned to the venous circulation, with the membrane oxygenator connected to the patient's lungs. If the application necessitates cardiac assistance, blood is returned to the arterial circulation via a catheter inserted into a major artery, commonly the right common carotid. The pump and membrane oxygenator are connected in tandem with the patient's heart and lungs in this application (Clinic, 2015; Shaw, 2008).



Figure 4. ECMO (Extra Corporeal Membrane Oxygenation)

## 2.2.4 Intra-Aortic Balloon Pump

The intra-aortic balloon pump (IABP) (Figure 5.) is a therapeutic cardiac assist device which aids your heart in pumping more blood (Smith, 2020).

The IABP is made up of a thin, flexible tube known as a catheter. A lengthy balloon is attached to the catheter's tip. This is referred to as an intra-aortic balloon. The catheter's other end connects to a computer console. This console features a mechanism that inflates and deflates the balloon at the appropriate times when your heart beats. The heart beats are detected by means of an electrocardiogram which forms part of the machines console, together with an arterial transducer (Smith, 2020). With insertion of the balloon pump device the use of a spiked vacolitre is required in order to connect up an arterial transducer. Here again the consideration to hand hygiene is essential in order to prevent cross contamination (Shapiro, Bailey, & Milowsky, 1966).



Figure 5. Intra-Aortic Balloon Pump

## **2.3. Possible routes of infection during Cardiopulmonary bypass**

### **2.3.1 Syringe sharing**

Medicine contamination can occur at a variety of stages, including manufacturing flaws, vial storage and breakage, syringe handling, preparation of medication and delivery thereof (Kwanten, 2019). Other possible contamination can occur with insufficient disinfection of intra venous ports/hubs or the tips of syringe prior to injecting. The potential for pathogenic bacteria can also be found in vials, syringes, needles, injection lines, ports, and vacolitre bags even before they are used on a patient (Kwanten, 2019).

Unused syringes left in the operating theatre were found to have an exposure rate of 10%, and the constant recapping of syringe tips was found to raise the contamination rate to 26.5 percent. This is most likely due to the syringe tip coming into contact with infected fingers or the theatre environment.

Adherence to fundamental prevention strategies such as WHO-based infection prevention and control guidelines by healthcare workers is vital for maintaining sterility of syringes and injection ports (Kwanten, 2019). However, Kwanten (2019), explains in his findings that , healthcare provider hand hygiene compliance rates have dropped to less than 20%, which may be explain in part the failure to recognize the necessity to wash one's hands after coming into contact with a contaminants or patients (Kwanten, 2019). This constitutes a lack of hand hygiene compliance resulting in the correlation of nearly half of high-risk stopcock contamination occurrences due to healthcare provider hand contamination, as identified prior to patient treatment (Kwanten, 2019).

Similarly, during cardiopulmonary bypass procedures, drugs are drawn up by the anesthetists and handed to the perfusionist in order to maintain the haemodynamic stability of the patient. This sharing of syringes poses a serious risk of contamination, as expressed by Hold (Hold, 2011). According to Tre'panier et.al (1990), when

syringes were used at the injection site nearest to the intravenous cannulae, approximately 3.3 percent of them contributed to infections (Tre'panier et al., 1990)

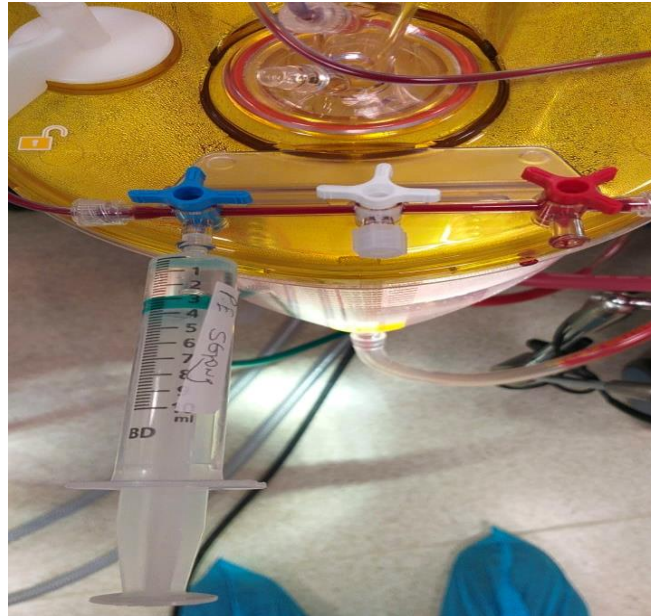


Figure 6. Syringe attached to venous reservoir

### 2.3.2 Connectors, Stopcocks and Ports

The connectors and ports are evidently concerning to perfusionists when discussing infection prevention.

*“Cross-contamination, I think, will be like if we use a contaminated syringe or something like that on the pump, I’m not sure how else we could cross-contaminate on the bypass” (Participant KC).*

Similarly, Hold, 2011, highlights that infected material can be found on needleless connectors and stopcocks and ports (Figure 7.), and suggests that it is necessary to therefore wipe down with alcohol swabs and close off if not in use (Hold, 2011).



Figure 7. Stop cock on the venous reservoir

Sengul et al. (2019), suggests that micro-organisms are capable of infiltrating into the venous system of the patient, due to the contamination by healthcare workers microflora due to hand hygiene or reused gloves (Sengul et al., 2019). However, they further posit that in order for such infiltration to occur there should be a significant number of pathogen colonies at the syringe tips of juncture sites, and therefore recommends that in order to draw to any conclusions more research needs to be addressed (Sengul et., 2019).



Figure 8. Cardioplegia Solution with a giving set

Bloodstream infections are commonly related to intravascular devices becoming a significant contributor to healthcare associated illnesses, and is related to increased patient morbidity and mortality. Bacterial contamination related to open-lumen stopcock devices have constituted up to 32% of cases and is a risk factor for increased patient death, most likely owing to infection. Subsequently, better intravascular catheter handling is required (Holroyd et al., 2014). The spikes on the bypass circuit where cardioplegic entry occurs, similarly end within the blood stream of the patient and there can be considered as point of micro -organism entry (Sarkar & Prabhu, 2017; Shao, 2018).

### **2.3.3 Airborne Pathogens**

According to Fencl (2014), HCAs are transmitted in numerous ways , with one of the transmission vectors being airborne. Airborne pathogens come into contact with open surgical sites, and even during respiratory procedures. Methicillin Resistant Staphylococcus aureus considered to be a deadly superbug, was found to self-perpetuate in closed environments such as operating theatres (Fencl, 2014).





Figure. 9. Open Bins in theatre

Clark & de Calcina-Goff (2009) posits that ensuring a hygienic environment plays a critical role in reducing airborne pathogenic transmission, and recommends that a conventional turbulent ventilation is not sufficient in reducing airborne microorganisms and that high efficiency filters may assist in reducing such contamination (Clark & de Calcina-Goff, 2009). Such research still needs to be explored in-depth.

Another factor to consider is the personnel in theatre who contribute to pathogenic airborne micro-organisms. According to Clark & de Calcina-Goff (2009), movement in theatre should be kept at a minimum and the use of appropriate theatre attire is especially necessary in reducing airborne pathogens that contribute to nosocomial infections (Clark & de Calcina-Goff, 2009).



## **2.4 Hospital acquired infection**

Infections that arise from a hospital stay is termed hospital acquired infections or nosocomial infections and are usually not displayed at the time of admission (Allegranzi et al., 2011). Such infections are typically prevalent in low and middle income countries where healthcare resources are relatively inadequate (Shahida et al., 2016). Since hospital acquired infections are understood to be an onset post admission, healthcare workers are therefore seen as a potential vector for pathogenic organisms (Bello et al., 2011).

Communicable illnesses are responsible for a significant portion of the world's illness and death, and infectious disease accounts for 62 percent and 31 percent of all fatalities in Africa and Southeast Asia, respectively, according to the World Health Organization (Curtis, Danquah, & Aunger, 2009). It is estimated that 3.2 million tons of infectious waste are generated from health-care and health-related establishments each year, according to the Environmental Protection Agency (EPA) (Alemayehu et al., 2005).

There is much indication that majority of health-care personnel in less-developed countries go about their everyday tasks without taking the necessary precautions when handling infectious waste products. Their personal protection equipment is also frequently insufficient (Mazhindu et al., 2012). This contributes to an overall concern over the possibility of widespread risk of deadly infectious diseases such as Tetanus, HIV, Hepatitis B, and Hepatitis C, as well as Leptospirosis, Q Fever, Hepatitis A, Salmonellosis, adverse reactions, dermatitis, and skin infections, pneumonia, influenza, trachoma/eye disease and intestinal parasitic infection (Mazhindu et al., 2012). Subsequently, these factors pose much stress on the healthcare system resulting in prolonged hospitalisation, continuous use of medication and additional hospital facility usage (Mazhindu et al., 2012).

## **2.5 Infection Prevention and Control Knowledge and Compliance**

It has been discovered that compliance with infection control procedures, such as hand cleanliness and the use of protective gear, varies substantially across healthcare professionals, and that this is possibly influenced by one's knowledge and attitudes regarding infection risk and behaviours (Whitby et al., 2007).

The provision of proper knowledge and understanding of IPC procedures has previously been shown to be effective in managing infectious illnesses (Mukwato et al., 2008). It is possible to significantly reduce the prevalence of healthcare-associated infections by putting in place proactive measures to prevent the spread of disease infection, such as hand washing (McDonald et al., 2018). Additionally, when Standard safety precautions are followed, "infection prevention and control" procedures become successful (Hayeh & Esena, 2013). The primary goal of all Standard safety precautions, is to reduce the number of infections associated with health-care service delivery, which will aid in the promotion of high-quality health-care service delivery (McDonald, et al., 2018).

According to Russel et al. (2018), despite the existence of well-established recommendations for the prevention of healthcare-associated infections, healthcare providers have been found to have low compliance with hand hygiene procedures (Russell et al., 2018). The lack of knowledge and/or attitudes towards infection control techniques may be the result of a variety of factors, including perceived impediments such as time constraints, the belief that protective equipment hinders work productivity, the availability of equipment, or patient discomfort.

Studies conducted on the knowledge and attitudes of health care staff regarding infection prevention and control (IPC) techniques found that there was low compliance with and negative attitudes toward infection prevention and control (IPC) measures (Caldwell, 2012). The findings of the study also found that factors such as educational qualifications, inadequate monitoring, lack of expertise and resources, and lack of funding were all factors that influenced the implementation of IPC measures. The majority of studies on infection prevention and control components in health care services revealed that knowledge and practices relating IPC strategies were prevalent (Magadze, 2012).

Amoran et al. (2013) probed into the training, knowledge, and practices of infection prevention and control procedures and found that staff understanding of IPC measures was insufficient, and those who did have information had acquired it through informal sharing of knowledge (Amoran, 2013). When Gammon and colleagues (2008) investigated IPC knowledge and practice among health care workers, they discovered a deficiency in both knowledge and practice despite appropriate provision for safe IPC methods, which also included personal protective equipment and resources. (Amoran, 2013).

Caldwell (2012) and Pittet et al. (2010) postulates that the implementation of infection prevention and control methods is more closely linked to the behaviour of health care workers who were found to not implement these measures for a various reasons (Caldwell, 2012; Pittet, 2010), however according to Jain, Mandelia, and Jayaram (2012) there is a need for advancement in the perceived notion and practice of infection prevention and control amidst health care workers (Jain et al., 2015).

## **2.6 Types of Nosocomial Infections**

### **2.6.1 Central Venous Line Infections**

All patients undergoing cardiothoracic surgery in theatre, are inserted with a central venous line (CVP) to ensure that the venous pressures are monitored and that there is direct access to the vascular system to administer drugs to maintain the patient haemodynamically stable (Shapiro et al., 1966). The CVP is a catheter that connects directly into the heart, and is therefore a critical source of infection. Such infections compromise patient recovery and contribute to an increase in health care costs each year (Khan et al., 2017).

### **2.6.2 Urinary Catheter Insertion Infections**

Urinary catheter insertions are essential in cardiac surgery, not only to relieve the bladder during surgery, but also to monitor urinary output. Although done under aseptic techniques, the possibility of patients contracting urinary tract infection or bacteriuria still remains considerably high. Urinary tract infections (UTI) are the result of bacteria entering the bladder during catheter insertion (Imam, 2020).

### **2..6.3 Surgical Site Infections**

Surgical site infections are those that develop at the surgical site of entry in the skin within 30 days after surgery (Darouiche, 2021). Due to the nature of infection and its means of development, surgical site infections are also referred to as HAI or nosocomial infections (Lemaignen et al., 2015). Nosocomial infections following cardiac surgery contributes to approximately 4% of surgical site infections and results in prolonged hospital stay and the possibility of death (Lemaignen et al., 2015).

### **2.6.4 Ventilator associated pneumonia**

Ventilator assisted pneumonia commonly occurs in the intensive care unit settings, and results within 48 hours after a patient has been intubated, and contributes to approximately 86% of hospital acquired infections (Khan et al., 2017).

## **2.7 Sources of hospital acquired infections and mode of transport**

Within the context of any hospital or healthcare facility, the transmission of numerous sources of infection exists which potentially leads to nosocomial infections. According to Prüss et al. (2002) the main sources of infections in hospital are personnel, patients and fomites such as the uniforms of healthcare workers as well as items of contact such as, beds, linen, curtains, equipment and common hospital surfaces (Prüss et al., 2002). This signifies the importance of acquiring the knowledge pertaining to infection control in order to ensure that hospital personnel take the appropriate measures. Duse (2005) explains that, developing interventions for infection control requires the need to understand the various sources and mode of infection transmission on the healthcare setting (Duse, 2005).

The transmission of nosocomial infections occur in three different methods, namely, air borne, contact or droplet spread.

*Contact* – This method of infection transmission occurs via contaminated hands of health care workers, usually by skin to skin or touching of shared surfaces (Duse, 2005).

*Droplet spread* - This type of transmission typically occurs during related procedures such as intubation, or bronchoscopies, coughing, sneezing, or just by merely

speaking. Since some droplets are larger, they do not stay suspended in the air but collapse coming into contact with the patient (Duse, 2005).

*Airborne spread* - This method although similar to droplet spread, results in the droplets to remain in the air for a longer period of time, due to its small droplet size or aerosol like nature and can infect a person that may be a further distance away from the origin of the infection source (Duse, 2005).

Additional modes of transmission of infection are, contaminated water supply, equipment needles and medical related solutions (Duse, 2005). It is, therefore, vital for all members of the healthcare team to be aware of the various methods in which nosocomial infections may spread.

Bacteria, viruses, and fungus are pathogens that cause nosocomial infections. Certain bacteria are distinct to their properties, and favour specific sorts of diseases in vulnerable hosts. The incidence of infections associated with specific microorganisms varies depending on the location of the healthcare facility, and the patient population.. Bacteria are the most frequent pathogens overall, followed by fungi and viruses **(Sikora & Zahra, 2021)**.

a) Bacteria are opportunistic and occur especially when the host immune system is depressed.

*Common Gram-positive organisms include:*

- Coagulase-negative Staphylococci,
- Staphylococcus aureus,
- Streptococcus species,
- Enterococcus species (e.g. faecalis, faecium).
- Clostridium difficile

*Common Gram-negative organisms include:*

The Enterobacteriaceae, namely, Klebsiella pneumoniae and Klebsiella Oxytoca, Escherichia coli, Proteus mirabilis,

Enterobacter species, namely, Pseudomonas aeruginosa, Acinetobacter baumannii, and Burkholderia Cepacian.

Acinetobacter was found to be associated a high mortality rate within the ICU setting, due to its multi drug resistance (Sikora & Zahra, 2021).

b) Fungi

Common places where fungi may develop, are at the central venous lines and particularly urinary catheters. Common Candida species, are namely, C. albicans, C. Parapsilosis and C.Glabrata (Sikora & Zahra, 2021).

c) Viruses

Viral pathogens, were found to be the reported as a contributor to nosocomial infections, since it makes up for approximately 1-5% of hospital acquired infections (Sikora & Zahra, 2021). However, with the recent pandemic, the SARS COV 2 virus was found to be more transmissible than other influenza virus (Roy & Ghosh, 2020).

## **2.9 Evidence of Poor Infection Control in South Africa**

According to Lowman (2016), South Africa shows very little evidence of hospital acquired infection surveillance programmes. Therefore, there is a lack in the proportion at which one can identify the route of nosocomial transmission. This is due to the possibility that such programmes are either being neglected or that insufficient resources are allocated to such programmes (Lowman, 2016). This is a clear indicator that evidence regarding infection control is lacking.

Duse (2005) identifies inadequate compliance with regard to hand washing, which contributes as a critical component of infection control and prevention (Duse, 2005). Healthcare workers that work in areas of high risk have shown to have been approximately 40% compliant with a hand wash routine (Du Plessis & Monkoe, 2010).

## **2.10 Factors contributing to poor infection control compliance**

### **2.10.1 Knowledge**

Prüss et al (2002) pointed out that knowledge regarding infection control and prevention is dependent on factors such as training and education, as well as healthcare workers having a positive attitude towards their responsibilities to infection control practices. In order to reduce hospital acquired infections, knowledge plays a vital role, that contributes to employees adhere to the rules that will lead to the elimination of health care associated infections (Prüss et al., 2002).

Several factors influence knowledge and compliance of infection control, namely, age, level of educational and training and access to personal protective gear.

### **2.10.2. Age**

Motamed et al. (2006), suggests that age plays a vital role in the compliance and practice of infection control and prevention. Their study conducted in Mazandaran Province in Iran found, health professionals that were between the ages of 20-30 to be more knowledgeable and practiced better infection control prevention than those that were over the age of 50 years old (Motamed et al., 2006).

However, Singh et al. ( 2011) implies that age does not play a significant contributing factor in barriers to learning. It should be emphasised that education and safer infection control methods are crucial for all health staff, regardless of age. To avoid age bias pertaining to knowledge, health officials should consider that training be delivered on a constant basis (Singh et al., 2011).

### **2.10.3 Education**

Currently there is a need to improve the education of health care workers in South Africa, since there are many contributing factors that inhibits attaining such knowledge (Duse, 2005). Language barriers plays an important role in infection prevention and control programmes, and therefore require innovative teaching approaches (Wurtz, 1995).

Although health care professionals are proficient in English, Dalin et al. (2008) argue that it is vital to conduct in-hospital infection control training soon after job placement

occurs and should be an on-going process, to reinforce infection control practices. A similar practice can be identified in medical students studying in Singapore, where students are taught infection control practices prior to clinical participation (Dalin et al., 2008).

#### **2.10.4 Attitudes**

A study conducted with student nurses and nurse mentors highlighted that, although healthcare facilities have infection control guidelines and protocols, employee attitude plays a critical role in compliance, they further identified a lack of hand hygiene practices not only with the student nurses and mentors but with doctors and qualified nurses alike (Ward, 2012). Subsequently, some people hold the opinion that infection prevention and control is an unneeded burden that shouldn't be included in patient care because it's time consuming and inconvenient, even though its importance in improving patient safety and outcomes has been well documented (Ward, 2012).

In summary, there is adequate literature pointing out the lack in hand hygiene, however, attitudes and various other factors contribute to improper hand washing techniques. Health care personnel must also be aware of the origins of infection and the means by which they spread. Subsequently, infection control knowledge can be influenced by factors such as education, training, age, and attitudes.

#### **2.11 The Risk Factors for Nosocomial Infections postoperatively due to Bypass Circuit**

The impact of nosocomial infections can be lethal for postoperative cardiac surgery, and has even greater implications in new-borns. The preceding literature identifies that the ports connected to the venous reservoir on the bypass circuits have the potential for the occurrence of bacterial infection leading to blood borne nosocomial infections (Coffin et al., 1997). Similarly, Shao (2018), highlights that the most frequent nosocomial infections were blood stream infections, catheter related and respiratory (Shao, 2018).

Sepsis, is also a leading cause for concern with hospital acquired infections. Studies carried out by Garcia et al. (2018), identifies sepsis to be the most common nosocomial infection in children undergoing congenital heart surgery, followed by



central venous line infections and then by ventilator related infections. Garcia et al. (2008) relates such infections to the prolonged exposure to the bypass equipment. (Garcia et al., 2018). Zhou et al. (2016), therefore points out that the use of prophylactic antibiotics, plays a critical role in preventing postoperative infections but can also lead to drug resistant organisms where prolonged hospitalisation is required (Zhou et al., 2016).

## **2.12 Non Compliance to Infection control practice**

Present research identifies a variety of factors that influence adherence to infection prevention and control measures. Suboptimal usage of personal protective wear has been associated with a lack of understanding the importance thereof (Timilshina et al., 2011). Studies also show a link between knowledge and hand hygiene habits in nursing and healthcare practitioners, with lower levels of compliance resulting from a lack of understanding (Suchitra et al., 2007) The confusion pertaining to increase in knowledge, increases compliance to infection prevention practices, as postulated by Dejoy et al. (2000) has been challenged by De Wandel et al. (2010) who further posited that the theoretical understanding of hand hygiene, has no correlation to practicing correct hand hygiene(DeJoy et al., 2000; De Wandel, et al., 2010).

Another important factor contributing to non- compliance is an increase in the workload, as well as skin related disorders (Pittet et al., 2004) which can be accompanied by the lack of hand hygiene related facilities (Borg et al., 2009). However, Lankford et al. (2003), suggests otherwise, and explains that increasing the available resources for hand washing, has showed no significant increase compliance (Lankford et al., 2003). This proposes an assumption that knowledge has no significant impact on compliance.

Factors to consider in promoting IPC compliance, may include having a positive attitude to IPC policies (Askarian., 2007) though research findings here are contradictory, in that, positive attitudes toward a precaution do not always lead to good levels of compliance with it (Burnett, 2009; McGaw et al., 2012).

Much debate also exist when it comes to different types of professionals and IPC compliance, for instance, more nurses were found to adhere to IPC practices in majority of the literature reviewed, than any other healthcare worker. However, at the

same time surgeons were found to wear protective eye gear during surgical procedures more than the nurses (Tantari & Mano, 2011).

Literature therefore clearly identifies that multiple factors contribute to non-compliance to IPC practices, together with discrepancies in the effectiveness of knowledge toward IPC practices.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter outlines the research method used to establish the knowledge and compliance of Cardiovascular perfusionists to infection control and prevention practices in theatre. The chapter covers the research design, the setting and method of data collection, the study population and sampling procedure, a detailed data analysis and ethical considerations.

#### **3.2 Aim of the Study**

This study aimed to determine the knowledge and compliance of Cardiovascular Perfusionists to infection control and prevention practices in theatre in the private sector of the healthcare environment in Central Durban, KwaZulu-Natal.

#### **3.3 The objectives of the Study**

To determine

- the knowledge of Cardiovascular Perfusionists in infection prevention and control in private practice
- the compliance of Cardiovascular Perfusionists to infection prevention and control practices in private practice

#### **3.4 Study Setting**

The study setting exclusively pertains to the practices of Cardiovascular Perfusionists in Cardiac theatre in the private healthcare sector in Central Durban, KwaZulu-Natal. Cardiovascular Perfusionists participating in this study are all private practitioners who practice independently. No participants recruited were from the public sector hospitals.

### **3.5 Research Design**

According to Kumar (2011), a research design can be compared to that of a blue print with the intentions of conducting research. This study was a qualitative research study method, based on a set of semi structured interview questions (Kumar, 2011). Semi-structured interviews include a series of important questions that help outline the areas to be investigated, but also allow the interviewer or interviewee to deviate in order to delve deeper into an idea or response. This interview approach is most commonly used in healthcare since it gives participants some direction on what to talk about, which many people appreciate (Gill et al., 2008). This approach is flexible and helps in discovering critical information that would never intentionally be communicated by the participants (Gill et al., 2008). The goal of a research interview is to learn about people's perspectives, experiences, opinions, and/or motives on specific topics. Qualitative approaches, such as interviews, are said to provide a "deeper" understanding of social phenomena than solely quantitative ones, like questionnaires (Kumar, 2011).

### **3.6 Data Collection Method**

Qualitative approaches are thus more appropriate when an in-depth understanding of real-world educational experiences is necessary, like in this case, to analyse and study real-world infection prevention and control experiences in clinical placements. Infection prevention research has used such methodologies to investigate issues such as perceptions of hand cleanliness and variations between observed and self-assessed levels of practice (Yuan et al., 2009).

Several diverse data gathering methods, including interviews, focus groups, and observation, are encouraged in qualitative research. These approaches are excellent for exploring experiences, beliefs, and opinions because they are based on first-hand knowledge. This goal of investigating and analysing experiences has to be taken into consideration when choosing on a method to use for the investigation. Observational approaches provide the researcher with first-hand knowledge of the participants, and the information can then be recorded and assembled (Kumar, 2011). It is possible to comprehend the behaviours and interactions of individuals without having preconceived assumptions by making unstructured observations of their actions and interactions (Bryman, 2012). Although this was considered to be an adequate

approach of gaining insight into experiences of infection prevention and control in clinical placements, it was ultimately determined to be ineffective.

Subsequently, this study used semi structured interviews which consisted of a series of essential questions followed by exploring for additional information (Patton, 2014). They are frequently the only source of information for qualitative research investigations (Kumar, 2011). In addition to a set of predefined open questions, other questions develop from the discourse that transpires between the interviewer and the interviewee during the course of the conversation (DiCicco-Bloom & Crabtree, 2006). In the field of qualitative research, semi-structured interviews are regarded a hybrid of the flexibility of unstructured interviews and the directionality of surveys, with the outcome being focused qualitative data (Kumar, 2011). This approach was deemed suitable for meeting the researchers overall goal and objective. In addition, one of the objectives of focused interviews is to broaden the scope of the topic by providing respondents with the opportunity to identify points of view that were not anticipated in advance of the session (DiCicco-Bloom & Crabtree, 2006). As a result, semi-structured interviews with clinical technologists were conducted with the help of the specific questionnaire design (Appendix C). The interviews were recorded on Microsoft Teams and transcribed and stored safely for future reference.

### **3.7 Sampling and Recruitment**

Compared to quantitative research, qualitative research seeks to attain distinct sorts of applicability or transferability (Bryman, 2012). As a result, it deviates from conventional probability sampling methods. Non-probability sampling can take several forms, including convenience, quota, and purposeful (Kumar, 2011).

Drawing on the concepts of Parahoo (2014) a purposive sampling approach was utilised in this research. Participants were deliberately chosen based on their ability to provide the necessary information. The rationale for selecting this strategy was that the researcher was seeking knowledge about the factors that influence the knowledge and compliance of Cardiovascular Perfusionists in the private sector with infection prevention and control techniques (Parahoo, 2014). By virtue of their previous experience, these participants would be therefore able to contribute.

In this study the purposive sampling approach used was not random and used all the cardiovascular perfusionists that work in private practice in central KwaZulu-Natal, who signed a consent form. It attempted to ensure that all aspects of job functions were represented. Participants were contacted via an emailed letter and invited to join the study together with the letter of information. Interviews were conducted with those who had offered their services voluntarily. In total, twelve cardiovascular perfusionists were interviewed.

### **3.8 Transcription**

There are some who argue that the interviewer should be the one to do the transcription of the interview. Theoretically, doing so will put the researcher closer to the material, allowing him or her to begin the analytic process by spotting themes earlier. It can also help researchers become more mindful of the possible correlations between the experiences of various people who have taken part in the research (Bryman, 2012). Consequently, this could be a time-consuming and tedious process. However tedious the process, the decision to transcribe the interview personally by the researcher was made (Kumar, 2011). Next came the option of whether to copy the conversation verbatim, including pauses, laughs, and so on. In some cases, verbatim transcription is not considered necessary, such as in organizational case or evaluation studies where broad patterns of themes are considered, or where specific interviewees are considered to be key informants, such as in organizational case or evaluation studies where broad patterns of themes are considered (Bryman, 2012). However, the purpose of this study was to investigate and consider experiences in greater depth, and it was anticipated that each participant would have something valuable to contribute. As a result, the approach chosen was complete transcription.

### **3.9 Analysis**

In this study, it was determined that thematic analysis was the most appropriate technique to pursue. Despite the fact that it is one of the most prevalent ways in qualitative data analysis, and that it is a method that is frequently cited in research articles, it is not recognized to be a distinct approach in and of itself (Kumar, 2011). When searching for an acceptable analysis technique, it was critical to remember that thematic analysis was not the last destination, but rather a starting point from which to investigate the techniques that were believed to be thematic in character. According

to Parahoo (2014), there are three fundamental principles that apply to thematic analysis, regardless of the approach used: balancing within case and cross-case analysis, organizing themes, striking a balance between clarity and inclusivity, and auditability (Parahoo, 2014). Therefore, it is clear that the technique of discovering patterns or themes within qualitative data is referred to as thematic analysis. Lopez and Whitehead (2013) argue that it should be the first qualitative approach mastered, as it forms the basis for all other types of analysis (Lopez & Whitehead, 2013). Thematic analysis serves to find relevant or significant themes, i.e. patterns in the data, and then use these themes to address the research or make a statement about a subject. A strong thematic analysis interprets and makes sense of the data, not just summarizes it. A common mistake is to use key interview questions as the major topics (Braun & Clarke, 2006). This usually indicates that the information has been compiled and organized rather than analysed (Ryan & Bernard, 1998).

In this paper all the data was transcribed by myself and the themes were collated by a statistician. This approach was considered in order to rigorously improve data analysis.

### **3.10 Ethical Consideration**

Ethical approval was obtained from the Institute of Research and Ethics (IREC) at the Durban University of Technology. It was communicated to the participants that they had the right to make their own decisions about whether or not to participate in this research. This was accomplished through informed consent as well as a letter of information (Annexure D) inviting them to take part in the study. Prior to conducting the interviews participants were telephonically instructed on how to use Microsoft Teams, as well as the recording features available inside the platform. Individuals who participated in the study were advised that they were free to withdraw from the study at any moment without danger of being victimized.

### **3.11 Pilot Study**

A pilot study was conducted prior to the main study. This was done to ensure that the questions were in fact applicable to the participants and if there was any need to edit the questions. The pilot study was conducted in a private Cardiac Catheterisation Lab which has the same infection control practices as the main theatre area. The interviews were conducted with five Cardiology Technologists, who had also obtained their Bachelor of Technology Degree in Clinical Technology but specialised in Cardiology. The interview was conducted via MS Teams and recorded.

- a) The pilot study found that although the environment was similar to theatre, the procedures carried out were not entirely similar, and therefore the questions had to be slightly reviewed in order to obtain the relevant information
- b) The cardiology technologists also worked both in the doctors rooms as well as the Cath Lab, so not all the questions were relevant to them.

### **3.12 Main study**

Twelve semi structured interviews were conducted with cardiovascular perfusionists practicing in the private sector. The CPs consented to participate in this study which was conducted via Microsoft Teams and recorded. The need to conduct a virtual meeting was due to the current pandemic, where social distancing was essential to prevent the transmission of the virus. Interviews were then transcribed verbatim.

### **3.13 Interview procedure**

The interviews were conducted with cardiovascular perfusionists from a semi structured questionnaire which was repetitive for all participants. Interviews lasted between 20 – 25 minutes. The process of the interview and the purpose thereof was first explained prior to commencing the interview.



## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Participants profile

This section detailed the profile of the participants in terms of their qualifications and job descriptions.

##### 4.1.1 Response

Table 1. shows the number of participants and the assigned pseudo names given to each of the participants. The participants were 12 in number who participated in the interviews.

Table 1. Number of Participants recruited in this study

Participants:	Assigned pseudo names
1	EN
2	DJ
3	DP
4	KC
5	KP
6	KP2
7	SKC
8	SS
9	TH
10	VM
11	AG
12	AP

##### 4.1.2 Level of education

The data in Figure 10. indicate that the overwhelming majority (91.7%) holds a Bachelor of Clinical Technology(B Tech: Clinical Technology), while one of the participants had a National Diploma qualification in Clinical Technology. It was uncovered that special consideration was given to those with National Diploma in Clinical Technology due to the age in the profession and experiences in the field and could therefore contribute to the research. This is what the participant said:

*“You know when I qualified there was no clinical technology, I’m one of the very first Perfusionists in South Africa, I’m so old. So I haven’t done a bachelor’s degree, what*

actually happened is that the Health Professions Council, decided to do a grandfather clause because of people like me, Ya, so that's my highest qualification, Ya, when I studied, there was only the nurses' college and ML Sultan, that's where we learned.” (SKC).

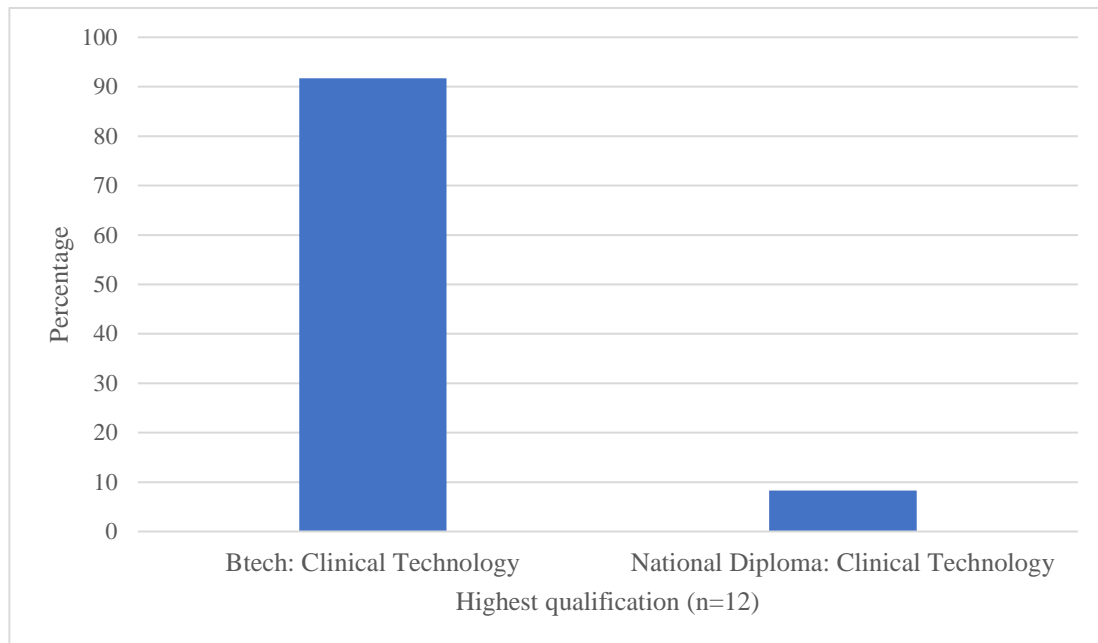


Figure 10 Graph depicting Participants highest level of education

#### 4.1.3 Job description

The job description of the participants is shown in Table 2. The participants were all specialized in cardiovascular perfusion and their description entails operating a heart-lung machine during cardiac procedures.

Table 2. Job Description

Cardiovascular Perfusion
<p>“I specialised in something called cardiovascular perfusion. And what this entails is, us making sure that a patient is kept alive during any cardiac procedures. So cardiac procedures are like your coronary artery bypasses valvular disorders and procedures like that “ (Participant KP).</p> <p>“The job entails operating a heart-lung machine, a cell saver, balloon pump, and [pause], many other types of equipment that is used to monitor patients haemodynamics during cardiopulmonary bypass procedures, but I also ehhe, sometimes operate the cell saver in spinal or orthopaedic procedures as well as gynaecology, and even general surgery” (Participant EN).</p> <p>“My job description, well I operate what you call a heart-lung machine, and it is a machine that supports you when you go for any bypass procedures, like Coronary artery disease, or mitral valve replacements, or any valve replacements, atrial septal defects and things like that” (1KC).</p> <p>“So I’m a cardiovascular perfusionist and my main role is to operate the heart-lung machine which is used to keep a patient alive during cardiac procedures” (Participant KP2).</p>

#### 4.2 Identification of themes and sub- themes

Theme	Sub-theme	Number Codes
1. Infection control and prevention (6 Subthemes)	1. Understanding of infection control	13
	2. Familiarisation with hospital infection control policies and protocols	19
	3. Familiarisation with infection control practices in theatre	7
	4. Hand hygiene techniques	15
	5. Training on infection control	14
	6. Compliance with infection control	13
2. Knowledge of healthcare associated hospital infection (3 subthemes)	1. Common disease	15
	2. Vulnerable patients	15
	3. Method of preventing and controlling hospital associated infection	16
3. Awareness of healthcare associated hospital infection (2 subthemes)	1. Cross-contamination	16
	2. Post-operation infection	14
4. Cardiovascular perfusion procedure (2 subtheme)	1. Involvement in CVP procedure	11
	2. Involvement in catherization	11
5. Precautions followed in cardiological surgery (4 subthemes)	1. Setting up pump	10
	2. Handling of biowaste	15
	3. Use of personal protection gear	15
	4. Unnecessary precautions	11

Table 3. Themes and Sub- Themes

Table 3. highlights the theme and subthemes that were extracted from the study findings. Themes were identified in an attempt to provide answers to the research questions as seen in Appendix C.

#### 4.2.1. Theme 1: Infection control and prevention

Infection control is becoming a global concern due to hospital-acquired infections (HAI) surfacing from multidrug-resistant bacteria occurring in patient's post-operatively, typically within a month of admission at the hospital. This theme explores the participants understanding as well as compliance with infection control and prevention. As illustrated in Figure 11, six subthemes were uncovered in this theme.

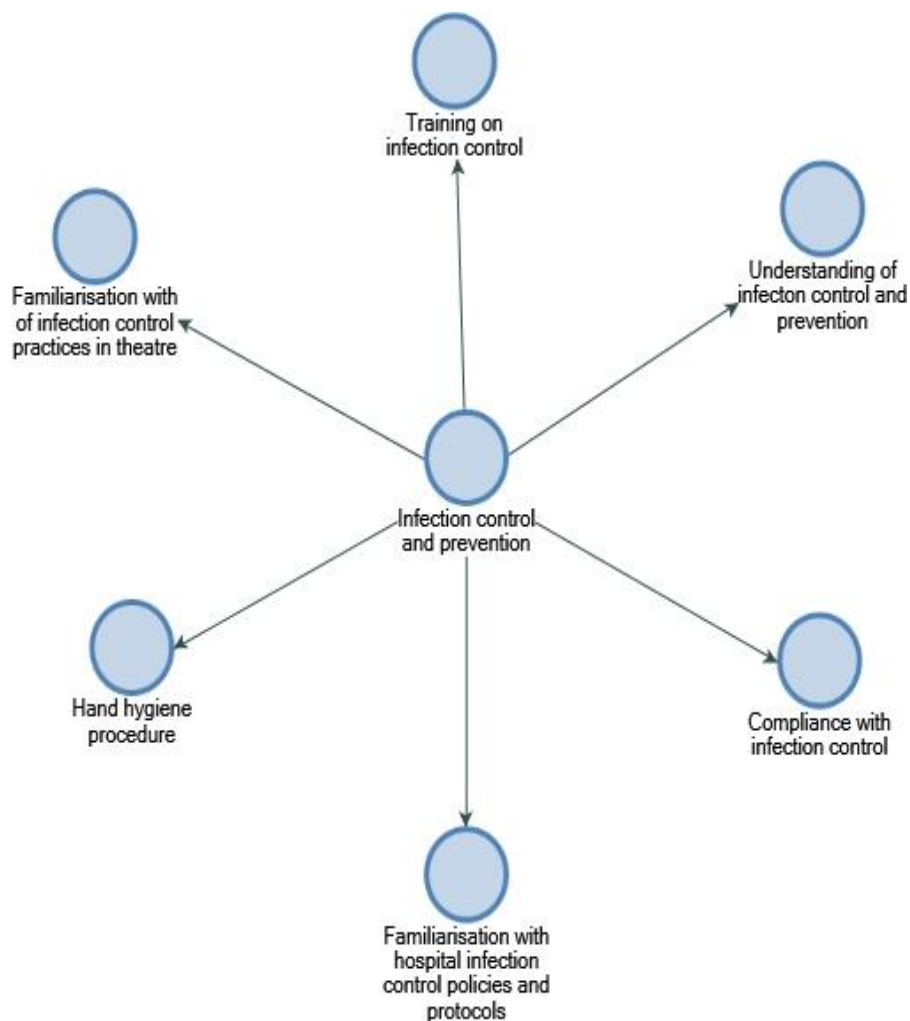


Fig 11. Visualization of Theme 1(Infection control and prevention)

#### 4.2 .1.1 Subtheme 1: Understanding of infection control and prevention

According to Mehta et al. (2014), infection prevention and control play a significant part in containing the spread of diseases. More particularly, the increased resistance to antimicrobials as well as the rapid spread of infectious diseases has brought to the forefront the relevance for good infection prevention and control (Mehta et al., 2014). As such, healthcare workers must have a strong understanding of infection prevention and control. All the participants interviewed appeared to have an understanding of infection prevention and control. Participants understanding of infection control entails the prevention of cross-contamination through hygiene practices, cleanliness, and sterility in the work environment.

An excerpt from the interviews is summarized below:

*“Infection control is basically, ways in which you prevent the spread of infections. Especially since we work in theatre and most areas in theatre become sterile areas once the surgical procedure begins” (KP2).*

*“Well, it is about how to make sure that the theatre environment is kept in an aseptic manner so that there is no spread of any infections” (AG).*

For some, their understanding of infection control entails maintaining cleanliness through proper hand hygiene practice.

*“Well, it’s to do with how we maintain cleanliness in the theatre, like with hand washing, and with like the red boxes and contaminated items that need to go in those red boxes and stuff like that” (VM).*

*“I think that is the hygienic manner in which you carry out yourself in theatre and how you operate around the sterile areas” (SS).*

*“In theatre, I think it involves how you practice hygiene. Like to prevent cross infections from you and to the patient, and like how to maintain sterility in theatre” (TH).*

While it can be drawn from the above narrative that the participants have a strong understanding and value the importance of infection prevention and control, Participant SKC statement, however, appears to suggest that the level of infection prevention and control practices among Clinical technologies had waned over time.

*“Oh my, in my days the nuns were actual nurses. And infection control was a very big thing. They were very strict, sometimes we felt like they will whip out a stick and beat us if we didn’t listen. Ya, you guys have it all easy” (SKC).*

#### **4.2.1.2 Subtheme 2: Familiarization with hospitals infection control policies and protocols**

A report by the World Health Organization (2015) estimates that out of 100 hospitalized patients, 7 patients in developed countries and 10 patients in developing countries will be affected by at least 1 episode of healthcare-acquired infection (WHO, 2015). Given this concern, Alyahya et al. (2018) stressed the need for the improvement of surveillance and infection control policies and practices, particularly in developing countries (Alyahya, Hijazi, Qudah, & Alshyab, 2018). Since South Africa is a developing country, it becomes prudent to know if the Clinical Technologist specialising in Cardio Vascular Perfusion, as interviewed in this study are familiar with hospital infection control policies and protocols and comply thereof. Of critical concern which requires urgent attention, was uncovering that many of the participants claimed not to be familiar with hospitals infection control policies and protocols.

*“Actually no I haven’t, I just assume that it’s the same as from the time we were in training like I told you earlier we were just explained to, on how to carry out ourselves in theatre. And like what we can touch or what we can’t touch, yah” (Participant EN)*

*“Actually, no I haven’t thought to do that, because we kind of just found out how to carry ourselves out in each hospital” (Participant DJ).*

*“No, I haven’t” (Participant DP).*

Participant KC attributed the lack of familiarization to not knowing where such policies are kept in the hospital. This suggests that the hospital needs to do more to acquaint all policies pertaining to the healthcare facilities to the healthcare workers in order to effectively enhance patient care in guiding the providers.

*“No, I don’t even know where they keep it” (Participant KC)*

It was not surprising that the participants are operating in terms of infection control and prevention - on the knowledge learnt most probably from other associates or from adapting it from other healthcare facilities.

*“No, I haven’t, to tell you honestly, I just go with what I was taught” (Participant KC)*

The above was reinforced by participant TH who hinted at the following:

*“No, I didn’t, I just go along with what I already know. I do read a lot, so I do pick up on my CPD activities that pertain to infection control and stuff like that. I think it will be more of an effort if I had to go and ask the theatre matron to read their policies” (Participant TH).*

From the above, one may assume that the participants are not keen nor interested to ask the nurses about the hospital policies. The reasons for this is exposed in the narrative below. Moreover, participant KP2 questioned the need for it. In the participants own defence, the following was stated:

*“No, I didn’t see the need, because I am aware of most of the practices, I mean I’m doing this for over 25yrs now” (Participant KP2).*

A similar sentiment was shared by another of the participants who noted the following:

*“Well, No, I think after all these years you kind of know” (Participant TH).*

Another reason uncovered as to why some of the participants were not interested in the hospital policies and infections may be associated with what may be termed professional ego or rivalry. For instance, participant SKC argued that the nurses are not better than them (Clinical Technologist) which suggests that there is nothing to learn from them.

*“No, I haven’t, because I mean all these nurses working everywhere, we all trained together you know, so I don’t think they know any better than me. We must know all the same things about infection control” (Participant SKC).*

Nevertheless, participant SS admitted taking it for granted. This is illuminated in the following statement:

*“No, I haven’t, I think I just took it for granted that it’s the same as when I trained in the public sector, so No, But I must say that most of the stuff I know is from CPD activities that I do on the internet” (Participant SS).*



#### **4. 2.1.3 Subtheme 3: Familiarization with infection control and practices in theatre**

As mentioned above, all the participants interviewed were not familiar with infection control and practices in the theatre.

*“No, I haven’t, there’s nothing in theatre, so I’m assuming it’s like kept away somewhere” (Participant SS)*

Others attribute their lack of familiarization with theatre policies on infection control and practices to knowing what to do and what is expected of them in the theatre.

*“No, I haven’t, I think because it never occurred to me to, because I felt like I know about how to behave in theatre, but also I don’t think it’s anywhere that we can see it” (Participant AG).*

*“No, I haven’t, I didn’t see the need to because I pretty much follow whatever is expected of me in theatre” (Participant KP)*

*“Nope, I pretty much have a basic understanding of how to carry myself out in theatre, because it’s similar in all hospitals I think” (Participant DP).*

*“No, no I haven’t, because I felt that I knew how to be in the theatre and stuff” (Participant VM).*

While participant KP was open to knowing if the matron can show or explain the policies for theatre, participant EN, however, saw this as a big issue, i.e., asking the matron to explain the theatre policies.

*“No, I would if the matron came to show me and explain the policies for theatre” (Participant KP).*

*“No, I haven’t, because none of the policies is kept in theatre, so that means I must go and ask the matron for it, a too big job that is” (Participant EN).*

#### 4.2.1.4 Subtheme 4: Hand hygiene techniques

According to Sartelli (2021), healthcare workers can prevent the spread of microorganisms, including those that are resistant to antibiotics and are becoming difficult, if not impossible, to treat by cleaning their hands (Sartelli, 2021). It thus implies that hand hygiene is closely related to the prevention and control of infection in the hospital. Consistent with this, participants EN and DP stressed the importance of hand hygiene in the prevention of the spread of diseases and viruses.

*“Hand hygiene is important especially in the prevention of the spread of diseases and viruses. So like washing your hands will be important in this aspect. I am aware of the scrub technique, but I haven’t ever done it. It looks long to do” (Participant EN).*

*“Well, hand washing is important to prevent the spread of any infection, I mean we all know that disease can be spread by the touching of surfaces, and I mean we hear that all the time, with covid now, we can see how important hand washing is to prevent the spread of it. When it comes to hand washing techniques, I’ll be lying to you if I said that I did the proper scrub technique” (Participant DP).*

Despite the above acknowledgement of the importance of hand washing, both participants regrettably noted to fall short when it comes to scrubbing techniques. The World Health Organization (2015) on hand hygiene approach defines the five key moments when healthcare workers should perform hand hygiene to include before touching a patient, before clean/aseptic procedures, after body fluid exposure/risk, after touching a patient, and after touching patient surroundings. Hence, it becomes critical to explore the hand hygiene procedure carried out by the participants in the cause of their work. From the excerpt of the interview, many of the participants appear to follow through the five key moments of hand hygiene. For instance, participants DJ and TH noted to wash hands before setting up equipment, after touching the patient, and when leaving the theatre.

*“Oh ok, well, I wash up before I start setting up my equipment, also before and after I possibly touched the patient, like when putting electrodes and stuff like that. I also wash up every time I exit the theatre, I think Covid has caused me to do that more frequently because I have to say that before covid I don’t think I washed and sprayed my hands with alcohol spray as often as I do now. I do know how to do the sterile scrub as the surgeons do. But I don’t personally wash my hands like that, it’s a bit impractical if you are moving around in a hurry all the time” (Participant DJ).*

*“My hand wash practices, I would like to think that it is good. I wash my hands regularly, usually before I start with the setting of the pump. And again after, also when I am near the patient I wear gloves, also if I do blood gases I use gloves. Since Covid started I think my hand wash practices have increased, Because I wash almost every hour, but not in the proper scrub technique, I think that will take too long, and waste too much water if I did that each time” (Participant TH).*

From the above, one could draw out that the scrub techniques required may not be practical for Clinical Technologies given that they have to move around all the time and waste too much water. This could also help explain why some of the participants noted to fall short of it. Hence, scrubbing techniques appeared to be practised only by the cardiothoracic surgeons. While many of the participants assumed that the scrubbing techniques is meant for surgeons and scrub nurses, participant SKC appeared to have a different view. In the participants' own words, clinical perfusionists were taught to use the same scrubbing techniques as the surgeons. It thus implies that the strictness of the infection control policies for perfusionists has declined over time.

*“Yes, hand washing is important in the management of infection in theatre. It prevents us from transmitting viruses and bacteria from one surface to another. Also, you know in those days, we were taught to do the same wash that the surgeons and the scrubs do. So you can imagine how strict the infection control policies must have been” (Participant SKC).*

Another handwashing technique uncovered entails washing the hand and thereafter spraying with alcohol spray. The alcohol spray might have been introduced due to Covid-19. The above assertion can be supported by the statements below.

*“Well, it is relevant, because I mean, we touch everything with our hands, so it is important that we wash it especially after touching common surfaces like door handles and stuff like that, and viruses and bacteria can be transmitted this way. I think Covid has taught everyone more than they need to know about hand hygiene and how the virus can transmit by touching and if our hands are not washed. But when it comes to the hand wash techniques, I don't think it is necessary for me to do that every time I wash, I mean I do it so frequently, I can't imagine standing at the sink doing the surgeons scrub technique like every hour” (Participant KC).*

*“Ok, well I think it has a lot to do with the spread of germs, and now with Covid, I think we wash our hands more than we even need to and we spray with alcohol spray, so much, I’m not sure if I can get drunk that way. With regards to hand washing techniques, I don’t use any special techniques. I think that’s overdone” (Participant KP).*

Overall, while the participant followed the basic five key moments of hand washing which is complemented by the use of alcohol spray, one of the participants, however, noted that it is the sister and surgeons that practice proper hand washing. This thus implies that strict hand washing hygiene, particularly the scrubbing techniques be implemented for every healthcare worker working in the theatre to reduce the risk of acquired hospital infection.

*“Yes, hand washing is very important to prevent any spread of infection between us and the patient. Hand wash techniques, I don’t think this applies to me, it’s usually the scrub sister and surgeons that do the proper hand washing” (Participant VM).*

#### **4.2.1.5 Subtheme 5: Training on infection control**

Infection prevention and control have been identified to be among the ten global threats by the World Health Organization strategic plan (WHO, 2019). To tackle these threats in healthcare settings, and ensure accurate and sustainable implementation of best practices, Tsioutis et al. (2020) stressed the importance of adequately and appropriately training and educating healthcare workers. Hence, this subtheme explores whether the participants have undergone any form of training on infection control (Tsioutis et al., 2020). Among the 12 participants, it was uncovered that 8 indicated never to have been previously formally trained in infection control. This is worrisome and requires urgent attention by the hospital management given the public health importance of adequate infection control practices.

*“No, I haven’t” (Participant KP)*

*“No, I have t been to anything like that” (Participant DP).*

Despite the absence of formal and or professional training on infection control practices, two participants acknowledged that there was an orientation on infection

control and that senior colleagues, as well as the nurses, also gave lessons on it.

*“No, no programme but the nursing staff and my seniors taught me about infection control when I was training, but not as a lesson, just like while we were in theatre” (Participant KC).*

*“No, that I can remember, ehh, I just know that when we got to the work environment, we had like an orientation of what the practices in theatre are, but there was never like a formal programme” (Participant EN).*

*“Ehhm, not that I can think off, Whatever I know I just picked up along the way, Like when you go into theatre then the scrub sisters usually tell you what they expect of you. And then you just use logic and basic knowledge of hygiene” (Participant SS).*

Participants KP2 and TH while noting that there was no formal training, also admitted to having attended a Covid-19 training organised by Netcare.

*“No, but recently Netcare had a covid training on donning and doffing, and I attended that, but other than that I’ve never been” (Participant KP2)*

*“No, most of what I know has been shown to me along the way, by the sisters in theatre and the ones that were supervising my training in the unit where I started. But I did go for a Covid training, but that was focused on donning and doffing” (Participant TH).*

Despite the lack of formal training, it can be gathered from the above narrative that senior colleagues, as well as the nurses, have made efforts in teaching some of the participants infection control practices. Also, it was gathered that some through personal efforts are engaged in some form of infection control training. On the other hand, four of the participants acknowledged having been formally trained on infection control and practices. Much of the training was revealed to have taken place at the nursing college as well as Inkosi Albert Luthuli Hospital.

*“Yes, we had to go, because we were trained in the nursing college, and we did most of the nurses' courses” (Participant SKC).*

*“Yes I have, I worked at one of the public hospitals in Durban, and it was a long time ago, but I remember they had a short training on infection control in the theatre. But it was a very long time ago” (Participant VM).*

*“Yes, I think I have been to one a long time ago, when I used to work at Inkosi Albert Luthuli Hospital, but that was a long long time ago. But then I also went for one recently, when Covid started then we had training on the spread of the virus and how to Don and Doff” (Participant AG).*

#### **4.2.1.6 Subtheme 6: Compliance with infection control**

Au et al. (2021) recently revealed that infection prevention and control practice is aimed to prevent the risk of disease transmission by contact with blood, bodily fluid, mucous membranes, and non-intact skin (Au, Suen, & Lam, 2021). Hence, one could easily assume that compliance with infection control is related to the risk of Hospital-acquired infections. Nevertheless, several empirical studies like those reported by Gammon et al. (2008), Lam (2014), and Pereira et al. (2015) have shown that compliance with infection control is suboptimal among healthcare practitioners in different countries (Gammon, Morgan-Samuel, & Gould, 2008; Lam, 2014; Pereira et al., 2015). Given this concern, this subtheme explores the participants compliance with infection control. Even though participants claimed not to be familiar with the infection control and practices policies in both the hospital and in theatre, it was uncovered that they still complied with infection control practices. The reason some of them gave to prove compliance was that they have been practising for many years and no single case of contamination was reported from their work (Gammon et al., 2008).

*“I think that I comply with the policies, because like in my 15 years in the private sector I have never been addressed regarding me causing any contamination or anything like that. So I think I am pretty compliant” (Participant EN).*

Participant VM also noted to follow the rules of infection control, and thus never had any problem with it.

*“Yes, I think so, I mean I do generally follow the rules and I’ve never had any problems you know” (Participant VM).*

Participants DP and KC statement suggest that they were not too sure about

complying with infection control. This is evident in the use of the words, “I hope I comply.” (Participant KC) and, “I think I do.” (Participant DP).

The above is somewhat concerning and may be attributed to the lack of training and or familiarisation with hospital policies on infection control and practices. This assertion can be further supported by the statement made by participant KP2 who noted to sometimes argue with some of the theories on infection control.

*“Yes, but sometimes maybe I do argue with some of their theories” (Participant KP2)*

Participant SKC also shared similar sentiments of debating with the infection control protocols. In the participant’s own statement, one could draw out partiality in treatment when it comes to enforcing infection control compliance.

*“I think most of the time I comply, but sometimes these sisters irritate me you know. They act as they know better but they are real slackers when it comes to infection control. Like sometimes the Drs bring their sweets and chocolates to the theatre, sometimes even food, but nobody tells them anything, and even if they take out their masks and eat, but when it comes to us Perfusionists, then there’s always some problem” (Participant SKC).*

Participant SS also shared similar sentiments on the unequal treatment in the theatre about compliance. This was blamed on why the participant may sometimes fail to comply with infection control.

*“Yes, I think so, but sometimes maybe not, maybe I feel like the surgeons get preference over me” (Participant SS).*

The above statements on partiality in the treatment of healthcare workers are concerning and requires urgent management attention to ensure adequate and complete compliance with infection control regardless of who is involved. The revelation also supports other scholars who had noted that compliance with infection control is suboptimal among healthcare practitioners in different countries (Lam 2014; Pereira et al., 2015).

Another concern that may be contributing to compliance issues could be associated with challenges some of the participants face with the nurses. For example, participant

TH acknowledged not complying when the sisters are being ridiculous while participant AG failed to comply when the sisters in the participant own words, are not logical.

*“Yes, maybe sometimes I don’t, But that’s only when the sisters are being ridiculous” (Participant TH).*

*“Yes, but not always, sometimes they talk garbage, I mean what they say sometimes isn’t logical” (Participant AG)*

#### **4.2.2 Theme 2: Knowledge of healthcare-associated infection**

According to the report by WHO (2017), hospital-acquired infection (HAI) is the most frequent adverse event in health care delivery systems. From a public health perspective, HAI is a major global public health concern that causes high mortality and rehospitalization rates and is associated with considerable preventable costs (Collins, 2008). More worrisome is the burden of endemic healthcare-associated infection in developing countries is higher than in developed countries, with an even greater epidemiologic relevance (Allegranzi et al., 2011). To mitigate against this, particularly in developing countries, the knowledge of HAIs among healthcare workers becomes highly critical. This theme explores the participants’ knowledge of healthcare-associated hospital infections.

As illustrated in Figure 12, the theme is discussed under three emerging subthemes namely, common diseases in hospitals, vulnerable patients, and methods of controlling healthcare-associated hospital infection.



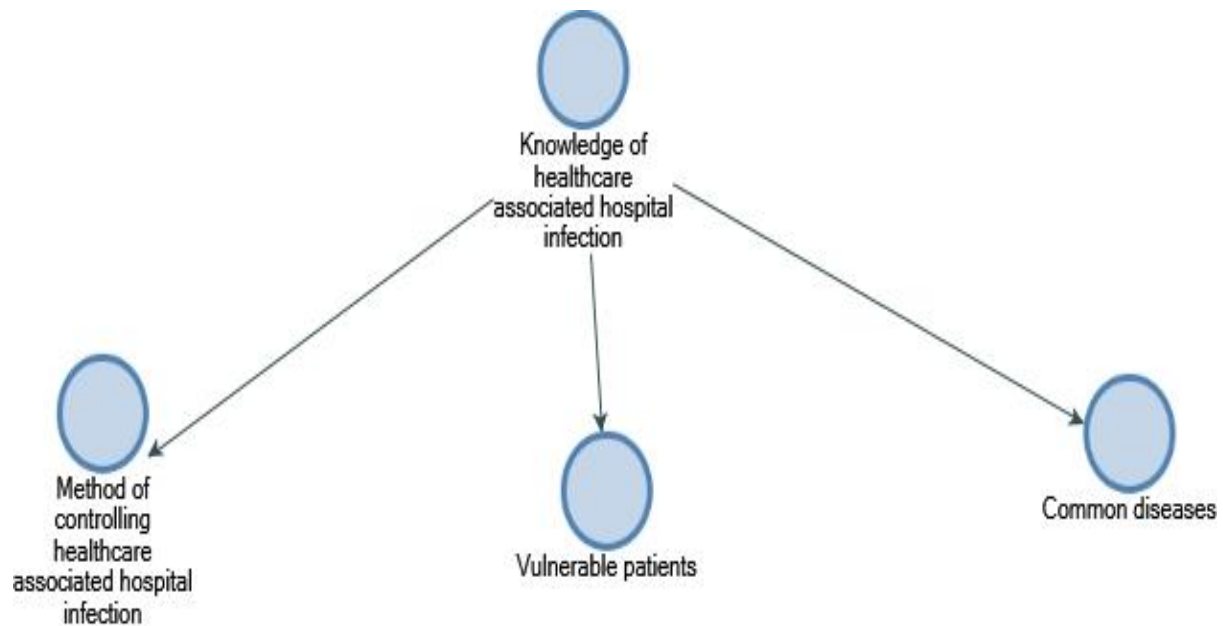


Figure 12 Visualization of Theme 2 Knowledge of Healthcare associated Infection

#### 4.2.2.1 Subtheme 1: Common diseases in hospital

Generally, HAI or nosocomial infections are not present or could be incubating at the time of admission to a hospital. From the interview, the common HAI the participants revealed include Carbapenem-resistant Enterobacteriaceae (CRE), Hepatitis, and Covid-19 virus. This can be corroborated by Friedrich (2019) who said that multidrug-resistant *Escherichia coli* and Carbapenem-resistant Enterobacteriaceae are becoming a problem of public health importance (Friedrich, 2019).

*“Yes, [pause], one that we hear of often in theatre is CRE, also like hepatitis, viruses, bacteria, [pause] ya. I think that’s about some of what I can think of for now” (Participant EN)*

*[Stammers],” Covid is one, and CREs, that’s quite common, Also other bacterial infections and viruses, like hepatitis, urinary catheters also cause infections” (Participant DJ).*

*“Yes, Covid is the most common, because it spreads between staff and patients, also I know that sometimes patients get urinary catheter infections, and I am sure like all other types of viruses and bacteria” (Participant DP).*

From the above, it can be gathered that urinary catheters are listed as among one of the frequent HAI. This is consistent with Monegro et al. (2020) who revealed HAI to include catheter-associated urinary tract infections, central line-associated bloodstream infections, surgical site infections, ventilator-associated pneumonia, hospital-acquired pneumonia, and Clostridium difficile infections. It thus means that there are risks of patients acquiring HAI from surgical devices (Mongero et al., 2016).

Another notable HAI uncovered is Covid-19. This is not surprising given that Covid-19 has become a major public health concern recently. This is reflected in the statement attributed to Participant KC.

*“Well, Covid, because I mean when the pandemic started we saw how the virus spread at the St Augustines hospital, then we also get patients that have CRE, so that’s common, but they are not common to come into the theatre, because most times these are happening in the ICUs and stuff, maybe sometimes we get a CRE patient, but I mean we all know about, how contagious it is, so usually, we treat such cases with extreme caution. And then of course are your usual viruses and bacteria” (Participant KC)*

Participant KP and KP2 shared similar sentiment by noting the following:

*“Well, I think Covid now is a common one, also we every once in a while, get a CRE patient. And I think other infections are probably like any virus or bacteria” (Participant KP).*

*“So like I’ve mentioned, the one we all know nowadays is Covid. Then there’s another common one we know, which is CRE, It is highly infectious, in fact, it is treated the same way in which we do covid because we actually don and doff in order to do those cases. And then its most viruses, and bacteria that can spread within hospitals between workers and patients” (Participant KP2).*

From the two statements, one could draw out that Covid-19 and CRE poses a significant concern to patients. These were revealed by the majority of the participants as a common HAI. The finding can be corroborated by Lecy-Schoenherr (2021) who found that the Covid-19 pandemic has increased the rates of HAI.

*[Pause] “Mmmh, a common one is CRE, that we all know, and now obviously like COVID. Of also hepatitis, we have to have a hepatitis vaccine before we start working in hospitals” (Participant SS).*

*“Covid, I think that would be the most common one now. But another one that I know of is CRE, I think usually from the ventilator, but obviously, it is all types of viruses and*

*bacteria's that patients can pick up from hospitals, even we can pick up these infections" (Participant AG).*

*"Yes, the most common one is CRE, and I also know that urinary catheter infections are common. Also most viruses and bacterial infections. Hepatitis, see some of these infections are not things that we pass to patients, but we can also pick up these from patients" (Participant TH).*

*"Yes, CRE is sometimes common, because we have patients you know, that came in for some problem, then they get CRE, because they have been in the ICU for a long, then sometimes they come for bypass, or something, that's when we hear of this infection. I know it when bacteria become resistant to antibiotics. Also, I know that some patients have urinary catheter infections. Even they come back for debridement or sepsis of the sternal wound. But it is not often. Yes, that's some of it" (Participant VM).*

In addition to the above statements, ventilator infections can also occur in the hospital. The similar sentiments are reflected in the statements below.

*"Yes, all viruses and bacteria can be picked up during your hospital stay. So you know one of the main ones are ventilator-associated, or even urinary catheter infections (Participant SKC).*

#### **4.2.2.2 Subtheme 2: Vulnerable patients**

While the risk for HAI may depend on the infection control practices, this could also be aggravated by certain predisposing factors in patients. Sydnor and Perl (2011) revealed factors to include immunosuppression, older age, length of stay in the hospital, and or multiple underlying comorbidities. Consistent with this, it was uncovered from the interview that patients with poor immunity and compromised immune system, comorbidities, diabetes, and hypertension had higher risks of HAI.

*"Mmh, I think like diabetics or people who have poor immunity" (Participant EN).*

*"Ehh, I think those that have a compromised immune system, maybe those that have comorbidities, like diabetes and hypertension" (Participant DJ).*

*"I think patients that have comorbidities, like diabetes, well that would be the ones that come for bypasses that would be most vulnerable" (Participant KP2).*

*"I think patients that have weak immunity, you know like some that are already sick from various diseases. Also not just be sick but they may have comorbidities like diabetes" (Participant VM).*

From the above, one could draw out that diabetes is a recurring risk cited, that nearly all the participants considered may be associated with being susceptible to acquiring HAI. This corroborates with Abu-Ashour et al. (2018) who said that people with diabetes may be at higher risk for HAI through both glucose-dependent and biologic pathways independent of glycaemic control. The plausible explanation for this may be attributed to the slow healing process in patients with diabetes. According to the views of participant KC, diabetes impacts the bodies healing process. This could also explain why diabetic patients are at a higher risk since they have to stay longer in the hospital.

*“I think the ones that have a weak immune system, they would be most vulnerable, also patients like that have diabetes, because diabetes, have an impact on the body healing processes, I mean it has a slowing down effect” (Participant KC).*

The above position can be corroborated by Pecoraro et al. (1991) who said that diabetes may result in compromised local circulation that leads to a delayed response to infection and consequently impairing wound healing. The impaired healing by a diabetic is further corroborated by participant SKC and TH.

*“I think patients have low immunity, but when patients come for cardiac surgery then I have to say, that maybe the ones that are diabetic. In my opinion, these patients take a longer time to recover from wounds, so they will definitely be vulnerable to hospital infections” (Participant SKC).*

*“Vulnerable, I think that would be people with weak immune systems, like people on Chemo, also people with co morbidities, I think a common one is a diabetes. Because most times diabetics have slower healing. So they would be vulnerable to infections” (Participant TH).*

Another condition that may increase the risk of HAI is cancer. This could be associated with patient compromised immunity. This view is accentuated by three of the participants who stated the following:

*“I think, that diabetics will be vulnerable, also like patients who have cancer and are having chemo, generally, all patients that are immune-compromised” (Participant KP).*

*“Mhh, most vulnerable, Maybe like those that have comorbidities like diabetes, or those that are going for chemo, you know, like the ones that have a weak immune system” (Participant SS).*

*“I think people that have a weak immune system. They would be the ones most*

*vulnerable to getting any infections” (Participant DP)*

#### **4.2.2.3 Subtheme 3: Method of prevention and controlling healthcare-associated infections**

According to Beggs et al. (2005) environmental hygiene is a fundamental principle of infection prevention in healthcare settings. This may be connected to the fact that contaminated hospital surfaces play an important role in the transmission of micro-organisms (Sartelli, 2021). As such, one could assume that the risk for hospital-acquired infections is dependent on the infection control practices at the facility. From the interview with the participants, it was uncovered that hand washing, the use of gloves, sanitizing and wiping instruments are the main method of prevention and controlling HAIs followed by them.

##### **(a) Hand hygiene**

According to Sartelli (2021) proper hand hygiene is the most important, simplest, and least expensive means of reducing the prevalence of HAIs. It was uncovered from the interview that participants’ practiced hand hygiene as a way of preventing and controlling HAIs.

*“Ehh, I make sure that the pump is wiped down and clean before I start setting up the tubing. I ehh, also make sure that I have washed my hands before I start, or sometimes I spray my hands with alcohol spray first. Also like, we have caps on the tubing,, so when I set up I make sure all these caps are screwed on properly. Ehh, also I make sure that I do not touch any of the connectors when connecting tubing. Ehh, ya” (Participant EN).*

*“I think like you have mentioned, it would be hand washing and sanitising” (Participant DP).*

*“Preventing infection, I think will be with regard to like your hand washing and maybe wiping down the equipment and machines, controlling it, I'm not sure, because in theatre there are so many people, so I don't know how you can control that” (Participant KC).*

*“I am not sure what the most effective way is, but I think that hand washing will play an important part in prevention” (Participant AG).*

From the above narrative, one could draw out that participants' practice hand hygiene procedures which include washing of the hands and sanitizing. Moreover, and according to Sartelli (2021), appropriate hygiene of surfaces and equipment which patients and healthcare workers touch is essential in reducing patients' exposure to HAI. A similar sentiment was shared by three of the participants who voiced that wiping down machines and equipment is also important.

*"I think, hand hygiene plays a critical role, but also I think that wiping down machines and equipment is also important, because the machines lie in theatre the whole time, patient after patient. So I think that is important to prevent infections from spreading" (KP2).*

*"I think that hand washing is important, also when we setting up our equipment we should be precautious that we don't expose any of the openings on the tubing and the reservoir. Also, we can make sure that our machines are clean and wiped down" (Participant SS).*

*"I think that it is important to maintain sterility in theatre. Like, try not to go to the areas that are sterile while the surgical procedure is on. Another important thing is to make sure that we wipe down our machine and equipment before and after the procedure because oftentimes, blood and fluids splash on the machine" (Participant TH).*

#### (b) Environment cleaning

Apart from proper hand hygiene and wiping down of instruments, the importance of a clean environment was also mentioned during the interview. According to the statement by participant VM:

*"You know, washing your hands is very important, but also, you need an overall clean environment, as I mentioned earlier, you know those red bins, and sharps containers and also the linen bags, are all important in theatre. You know you have to look at all this first before we can say what is effective or not" (Participant VM).*

The above view further supports Sartelli (2021) who said that the sanitization of the environment has been another crucial aspect of the COVID-19 containment.

#### (c) Use of gloves

Another measure that should be noted in the prevention and control of HAIs is the use of gloves. According to Moran and Heuertz (2017), the use of disposable nonsterile

gloves in the hospital is second only to proper hand washing.

*“Ehh , I think to wash your hands, or maybe wearing gloves” (Participant DJ).*

*“I think that would be hand washing. Or even like wearing gloves, or sanitising frequently” (Participant KP).*

Moran and Heuertz (2017) argued that since handwashing is not consistently practised, the use of gloves is warranted to reduce contamination during patients' contact. However, it is essential that the correct disposal of gloves is required as Moran and Heuertz (2017) suggests that hand gloves have the potential to harbour nosocomial pathogens. So, it is of vital importance to state here that the use of gloves is not a substitute for hand hygiene, as improper use of gloves could increase the risk of HAIs transmission (Au *et al.* 2021).

Participant SKC alerted as a cautionary measure that HAIs are not absolutely preventable but nonetheless admitted that it could be controlled to some degree if healthcare workers followed the rules in the theatre.

*“I don't think it's absolutely preventable, but you can control it to some degree, you know following rules in theatre would be one way” (Participant SKC).*

#### **4.2.3 Theme 3: Awareness of healthcare-associated hospital infection**

According to Akanbi *et al.* (2017), the rampant cases of HAIs is associated with the hospital environment. Hence, strong awareness of HAIs among healthcare workers is critical in prevention and control. This theme explores the participants' level of awareness of healthcare-associated hospital infections. As illustrated in Figure 13., the theme is discussed under two emerging subthemes namely, cross-contamination, and post-operation infection.

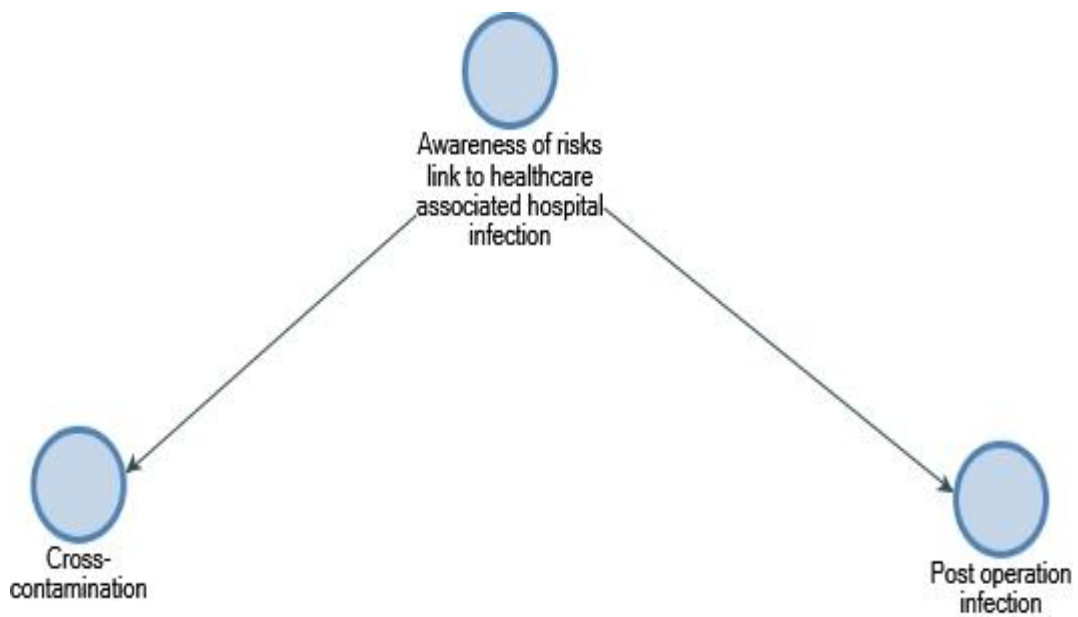


Figure 13. Visualization of Theme 3: Awareness of Risks linked to Healthcare Associated Hospital Infection

#### 4.2.3.1 Subtheme 1: Cross-contamination

In the hospital setting, close contact between healthcare workers and patients is unavoidable, even in situations where hygiene is critical. This may increase the likelihood of cross-contamination from healthcare workers to patients and vice versa. This is illuminated in the statement below.

*“Risks, I think it would be passing some form of infection from me to the patient or from the patient to me” (Participant KP2).*

From the above second narrative by participant KP2, one could draw the importance of sterilizing surgical instruments. This can be corroborated by other studies where it has been shown that surgical site infections may be linked to ineffective decontamination of surgical instruments (Muchina & Muchina, 2009) .

Furthermore, the syringe may be another surgical instrument that possess the risks of cross-contamination (Kwanten, 2019). As noted by Participant EN, touching the edge



of the syringe or spike could increase the chances of cross-contamination.

*“[Pause], yes, I think that risks are not only for us to the patient, but also from the patient to us, or between us healthcare workers, ya oh also like when you touch like the edge of the syringe or spike whilst inserting it into a fluid bag like 1liter saline” (Participant EN)*

The above view is also supported by three of the participants who hinted at the possibility of the syringe serving as a source of cross-contamination.

*“Cross-contamination, I think, will be like if we use a contaminated syringe or something like that on the pump, I’m not sure how else we could cross-contaminate on the bypass” (Participant KC).*

*“[Pause], cross-contamination, I think I would think could be maybe if I used a syringe that fell on the floor or if you use reused a needle or something like that, and it would obviously pass some infection, or like bacteria something” (Participant SS).*

*“I don’t think anything really, only like I mentioned earlier if, we touch the spike of that we use for cardioplegia or something like that. But other than that nothing really from my side. But there is a possibility if we use a contaminated syringe because that is the only thing that would come into contact with the patients’ blood products” (Participant TH).*

Another possibility or source of cross-contamination may be from the doctors and or nurses.

*“Honestly, I can’t think of anything. Because it won’t be coming from my side, maybe from the surgical side and the nurses but nothing really from my side (Participant SKC).*

The above assumption can be confirmed by scientific evidence where it is shown that healthcare workers contribute to cross-contamination in the hospital setting. For example, Moran & Heuertz (2017) suggest the possibility of cross-contamination from unused, disposable nonsterile gloves to hospitalized patients. According to the authors, healthcare workers introduce skin commensals and pathogenic bacteria onto gloves and into glove boxes during routine use (Hughes et al. 2013). Another source of contamination by healthcare workers may be linked to the garment worn by healthcare workers (Akanbi, et al., 2017).

From the above narrative, one could draw out that healthcare workers negligence such as a contaminated syringe, worn garments as well as patients' hygiene are sources of cross-contamination. The consequence of this is accentuated by two of the participants who noted the following:

*“Ehh, well the risks I would think, is that the patient could end up with sepsis, and possibly die, or I could pick up something from the patient that I could take home, and risk my family becoming infected” (Participant DJ).*

*“I think the risks of cross-contamination would be like transmitting some deadly disease to someone else, which could end fatally” (Participant DP).*

#### **4.2.3.2 Subtheme 2: Post-operation infection**

Although the WHO have put into place infection control guidelines, private hospitals create their own or policies and guidelines that are suitable for the respective area and country (Dramowski, 2020). However, the possibility still exists that not all healthcare practitioners adhere to infection control practices, and therefore may be a contributing factor to HAI or SSI post operatively (WHO 2013). From the interview transcript, all the participants refute that they contribute to post-operation infection.

#### **4.2.4 Theme 4: Cardiovascular perfection procedure**

This theme explores cardiovascular perfectionist activities that may contribute to the risks of HAIs. As illustrated in Figure 14., the theme is discussed under two subthemes namely, involvement in Cardiovascular procedure and involvement in catherization.

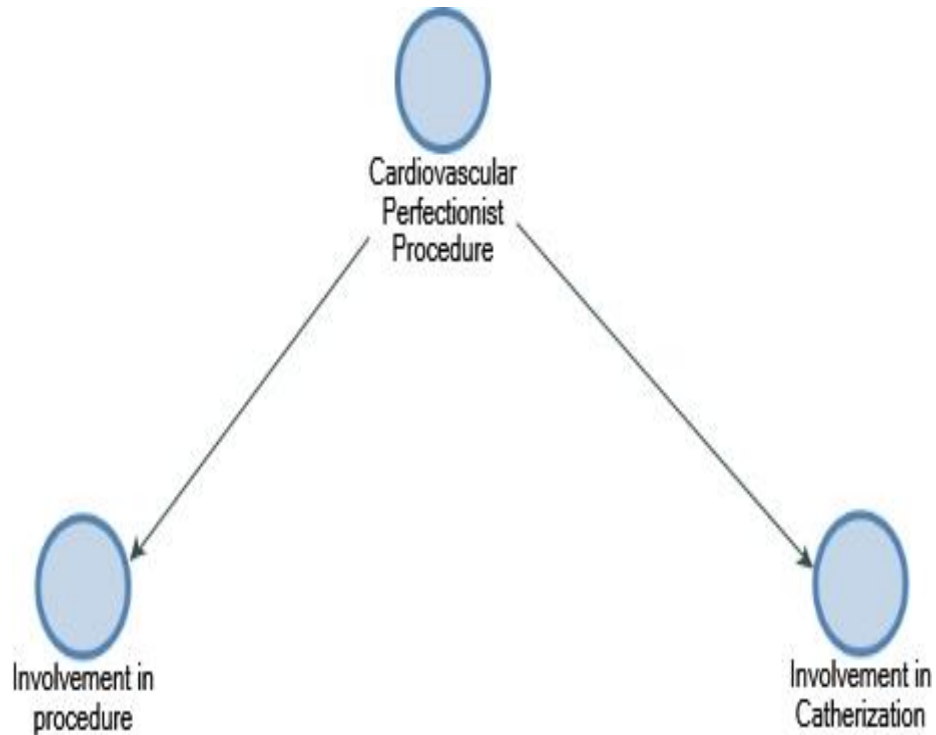


Figure. 14 Cardiovascular Perfusionist Procedures

#### 4.2.4.1 Subtheme 1: Involvement in Central Venous Pressure(CVP) Line Insertion Procedure

In terms of involvement with the CVP, it was uncovered that the participants were not directly involved in the insertion of the CVP. From the data analysed, the only part the participants played in the procedure was set up the transducer and monitoring the reading of the pressures.

*“No, the only thing for me to do with the CVP is making sure it is reading on the monitor, so I don’t have anything to do with inserting it” (Participant KC)*

Participant DJ revealed the anaesthetist and anaesthetic nurse are usually responsible for inserting the CVP.

*“No, the anaesthetist and the anaesthetic nurse usually work together when inserting a CVP, I have no direct contact with this procedure” (Participant DJ).*

As such, the participants' participation in the procedure only comes after the anaesthetist has catheterised the patient. This is illuminated in the statements below.

*"[Pause] yes, not exactly like directly, but like we set up transducers, and then we connect up the cvp so that we can monitor it. But like this is only after the anaesthetist inserted it in an aseptic manner, then they cover it with a dressing, yah, then only do we connect it to the monitor" (Participant EN).*

*"Well, not directly, because I am not involved with the anaesthetist at this point, but I do sometimes have to zero the line, but even that is from the transducer and not directly at the CVP insertion site" (Participant SS)*

*"Well, I'm not directly involved, my job is to make sure that a transducer is set up and ready to monitor the CVP, so the only thing I may do during this procedure is to connect the tubing after the CVP has been inserted and covered in a dressing. I do know that CVP sites are direct access to the heart and can be a major contributor to cross infections" (Participant TH).*

#### **4.2.4.2 Subtheme 2: Involvement in Catherization**

In terms of the participants' involvement in urinary catherization, it was uncovered that none of them gets involved in the procedure.

*"No not at all" (Participant DP)*

*"No" (Participant KC)*

*"No, not at all" (Participant TH)*

#### **4.2.5 Theme 5: Precautions to follow for Cardiothoracic Surgery**

This theme explores the participants' knowledge of healthcare-associated hospital infections. As illustrated in Figure 15., the theme is discussed under five themes.

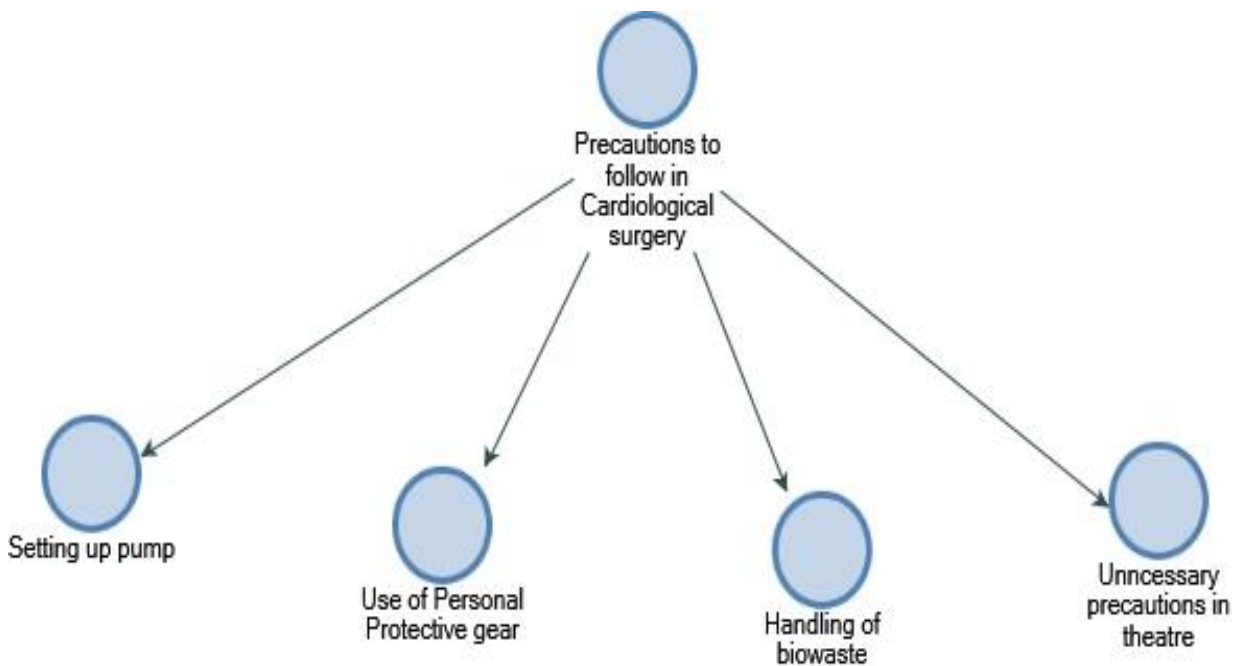


Figure 15. Visualization of Theme 5: Precautions to Follow in Cardiothoracic Surgery

#### 4.2.5.1 Subtheme 1: Setting up pump

Setting up of pump or in other words the heart lung machine, is the only direct contact the participants make during the cardiothoracic surgery. Given the need to prevent and control the HAIs at all fronts, it was essential to know the process followed in setting up the pump. According to Participant DJ, it is vital that the connectors are not touched and hands are washed before starting the setup. This may be a way to limit the contamination of the equipment.

*“like I mentioned before, I ensure that the caps on the reservoir are screwed on so that nothing is exposed, don’t touch the connectors, oh and wash your hands before you start setting up. So I think that’s about it” (Participant DJ).*

Another safety measure during setting up is the use of sterilized blades. This is reflected in the statement below.

*“You know, the problem is that we don’t like to have a dedicated room where we can set up, so it’s a bit difficult because you know our tubing packs are open while the patient and nurses and stuff are in the theatre. So the only thing we can do is like while setting up, one of the main things we were taught to do is to make sure that we use a*

*sterile blade if we are cutting tubing, because you know sometimes the tubing is very long” (Participant DP).*

Participant DP also stresses the importance of tightly securing the caps to eliminate contamination.

*“And also we make sure that those small caps on the reservoir is screwed on tightly because usually, those can fall off and not only cause air bubbles to get into the circuit but also cause contamination of the blood. I mean that’s about it we can do” (Participant DP).*

Other participants also narrated the hygiene procedures during setting up.

*“Well, we have to make sure that we are setting up in an aseptic manner because our tubing comes into contact with the patients’ blood, so I make sure that I wash my hands before I start, also we often have long tubing, so sometimes the sister’s come and leave a sterile pack of scissors and tube clamps, sometimes I use that but mostly I use a sterile blade to cut it. I just feel it’s cleaner because you know when you keep it aside you can just slip it back into its packaging. And also we have these small caps on our reservoirs, so we try to make sure those don’t fall off by tightening them. And we administer drugs sometimes on the pump, so we must make sure that all needles and syringes are capped. Even we spike 1-litre bags, so I try not to make sure that I do not touch the spike and always cap it if it’s not being used” (Participant KC).*

*“Well, from the time we started as interns we were taught to make sure to keep our tubing clean, that means basically, like keep it from being exposed to any contaminants, for example in theatre, when we start setting up, we make sure to have like a sterile blade near in case we need to cut any tubing, also our syringes and stuff are always capped and we don’t like mix needle that has been used to draw up any drugs. So also the reservoir has small caps on it, so we try to make sure that we tighten these caps. Also if we mix plug, then we don’t leave any of our spikes uncapped” (Participant AG).*

*“So, obviously, wash my hands first, but you know it’s so hard to make sure that you are not touching anything contaminated, because when we open up our tubing it’s not in a sterile setting, but I suppose that the inside of the tubing is the main aspects of making sure it is not exposed to any sort of contamination. So for this part, we usually try to not touch any of the parts that will come into contact with the patient, so like on the reservoir, there are like little caps, so we make sure all these caps are tightly screwed on, also for like cutting tubing to shorten it, we use a blade, a sterile blade. But I don’t think there’s anything else that is really like aseptic that we can do” (Participant KP).*

From the above, it is sufficient to say that the participants follow all necessary precautionary steps to limit contaminating the pump during setting up. This is of vital

importance to limit the spread of HAIs as well as cross-contamination. This view is corroborated by participant TH who emphasised the importance of not touching the spike as it could be a source of cross-contamination.

*“Another important thing I think is that when we are spiking like the cardioplegia or the Balsol bags, I believe we should make sure that we do not touch the spike because this can be a source of cross-contamination. And with our work, there's a lot of connectors and caps, and tubes, so all these should be kept in a sterile manner because these come into contact with the patients' blood. So it is important to make sure that we keep it clean and sterile” (Participant TH).*

#### **4.2.5.2 Handling of Bio waste**

Bio-waste can be viewed as any medical waste generated from various health care delivery processes such as dialysis, surgery, chemotherapy, autopsy, biopsy, and injections (Sapkota et al., 2014). The concern that is of most importance to healthcare workers is that medical waste could contain harmful microorganisms with the potential to infect patients, healthcare providers and the general public (Sapkota, Gupta, & Mainali, 2014). As such, it becomes extremely critical to explore how the participants managed and handles bio-waste to limit the risks of HAIs. According to the statement attributed to participant DJ, there appear to be poor disposal for hazardous waste. This is concerning given the fact that hazardous waste could potentially transmit infectious diseases (Okada & Ito, 2000).

*“The hand wash items are always available, the gloves and aprons, but the bins for hazardous waste is problematic because there isn't a proper one in place” (Participant DJ).*

*“Yes, Hand wash and cleaning agents are always found in abundance, but not bins for biohazardous wastes, we are always begging for things to put our bypass circuit in” (Participant KC).*

*“There's always hand wash, we don't have like dedicated bins for disposing of our circuits” (Participant KP2).*

Participant DP shared a similar concern as above on the lack of appropriate waste handling.

*“Yes, there is hand soaps, disinfectants and stuff like that but, I have to complain about the disposal of waste methods. There’s like no proper bins, there are red packets but I mean you can’t cram the whole circuit in there without tearing the packet and stuff, you know” (Participant DP).*

The inappropriateness of the waste bins were illuminated by participant VM as follows:

*“Yes, we always do, the private hospital provides all these things for us. They do provide red bins and sharps containers, but I’m not happy with the way in which they expect us to dispose of our bypass circuit. They don’t provide us with proper items to dispose of our things in, you know these bucket things don’t have lids, and sometimes the buckets tip over because our stuff is quite heavy and all the blood and stuff goes everywhere” (Participant VM).*

The above is a concern and requires urgent attention by the hospital management. Particularly, a contaminated environment presents a high risk to both patients and healthcare workers contracting HAIs. This assertion can be corroborated by participant TH who revealed the risk it could pose to other healthcare workers such as waste handlers.

*“Yes, there’s always stuff available, except they lack in what they provide for us to get rid of our disposables. Even the cleaners complain to us and tell us that the blood spilled whilst they were carrying the waste” (Participant TH).*

This concern is also reinforced by three of the participants who stressed the public health concern of inappropriate health disposal.

*“Yes, I wouldn’t expect any private hospital wouldn’t have such things. But the bins for biohazard waste I think can be a problem, because we don’t always have them. You know sometimes the red buckets are still full of waste from the previous day which is unacceptable. Yes, so I think that is a major problem in theatre” (Participant SKC).*

*“Yes, I would be very concerned if they didn’t. but they do not have adequate systems in place for disposing of our tubing and reservoir, I mean we actually throw them in baskets that look like laundry baskets. And these tubing and reservoir have blood products in them, so it’s not suitable for them to just be put into these open laundry baskets” (Participant AG).*

*“Well, I think in a private practice setting, you always have stuff available to wash. The sharps containers, I must say most often than not is always full, and rarely changed, which is quite annoying, because we are always disposing of blood gas syringes and act tubes, and if there isn’t one available we have to through it into the red bins*



*because you know we can't leave bloody items lying around. But the biggest irritation of all is that we don't like to have a dedicated red box for the bypass circuit. You know it's so much tubing and the reservoir is so big and we actually end up throwing them into these open baskets, it has a red bag but it is an open basket, so I don't really know how hygienic that is especially for the cleaners" (Participant SS).*

Furthermore, studies have shown that inappropriate infectious waste management may result in HAIs such as Hepatitis B, Hepatitis C, Human Immunodeficiency Virus, and other pathogenic organisms (Deress et al., 2014). Also, it was uncovered there is inappropriate handling of sharp objects. This is illuminated in the following statement:

*"Yes there is enough of that, except you are guaranteed to find a sharps container full of needles and then you cannot put anything else in there but it just left like that waiting for you to tell them to get a new one" (Participant EN)*

The above is of particular concern when one considers that unsafe handling of contaminated sharps waste may lead to the transmission of viral pathogens including the Hepatitis C virus and HIV (Hossain et al., 2013)

#### **4.2.5.3 Subtheme 3: The use of the personal protective gear**

It is generally assumed in the literature that hand and/or environmental hygiene and/or single-room isolation in combination with personal protective equipment could reduce HAIs. Au et al. (2021) reveal that the practice of hand hygiene, the use of gloves, and respiratory protection are the important elements of infection control and practices. From the interview, it was uncovered that participants' use personal protective gear such as apron, gloves, goggles, and masks to protect themselves from HAIs.

*"Honestly, before covid started, I have never worn an apron or gown, even gloves or visors all the time, I used to wear my mask, but not all the other stuff, but honestly, since covid, I have been wearing full-on PPE all the time when in theatre. Ehh, although I must say, we were not supplied all the relevant PPE, we bought our own. We only used to get masks and aprons as well as gloves. Oh yea, we also wear shoe covers and cover our hair all the time. Ya " (Participant EN)*

*"Ehh, so the protective gear that I wear is just a mask and gloves, I sometimes wear a visor, but only if we are doing any PUI patients or CRE patients. But when covid started, then I've been wearing my visor more frequently because some patients were coming in negative and then testing positive like a few days later. Ehh, with regard to*

*the provisions of PPE, yes we do have access to gowns and gloves and masks, but when covid hit, then we had to purchase our own N95 masks, but it seems to be settling down again, and the hospitals are becoming fully stocked with PPE again” (Participant DJ).*

Equally relevant, it was uncovered that Covid-19 had improved on the practices of the use of personal protective gear. This is reflected in the statements below.

*“[Stammers], actually, I never used to before Covid, I think I only used to use a mask, gloves and maybe an apron if the patient was HIV positive or something, but other than that nothing really, However, when covid started then I started to wear my goggles, an N95 mask, or KN95, apron, gown, and gloves. I think that’s about it” (Participant SS).*

*“Yes, all the time, especially now with Covid, we have to be careful, because sometimes patients come in negative and then a few days later they test positive” (Participant DP).*

*“Before Covid came and caused chaos, I used to just wear my mask and gloves, but now, I try to wear a double mask or KN95 mask, visor, or goggles sometimes, and an apron and gloves, because I found that we wash our hands so often, you know it damages the skin” (Participant KC).*

*“Protective gear, yes I do, especially now with covid around, I wear an N95 mask, visor, and gown. But prior to covid, I think we only used, well I only used, a normal blue mask, and gloves, and only if we had like an HIV positive patient, then I would use the full-on gear, but never really, had like a full PPE in theatre” (Participant KP2).*

*“Yes, I do, I wear my mask and my gloves. But now with covid around, I wear my visor and KN95 mask” (Participant SKC).*

*“Well, now with Covid around, I think that is easily answered because I wear, my goggles, my KN95 masks, and then a normal mask on top. I wear an apron and gloves if I’m needed to assist with anything at the table. I also wear a face shield when the patient is being intubated. When doing blood gases, as I’ve said, I also use gloves then. So I think that with covid also a lot of things have changed with regards to infection practices in theatre” (Participant TH).*

The above narrative suggests that Covid-19 has driven the need to comply with the prevention and control practices of HAIs. This can be corroborated by Sartelli (2021) who said that the Covid-19 pandemic has highlighted the importance of infection practices and control as well as the necessity for supporting the understanding of its practices to prevent HAIs (Sartelli, 2021). The long term implication of this is that

increase in the use of personal protective gear will likely impact the spread of HAIs in a hospital setting (Sartelli, 2021).

#### **4.2.5.4 Subtheme 4: Unnecessary precautions in theatre**

While precautionary measures are essential to combating HAIs, some of the participants, however, were of the opinion that there were unnecessary precautionary practices in theatre that did not sit well with them. Some of these are reflected in the statements below.

##### **(a) Prohibition of smart watches**

Participants expressed concern that they could not understand the prohibition against wearing smart watches. This concern is evidenced in the fact that they are allowed to wear wedding rings and not smart watches. Hence the logic against this eluded them. More so, it was revealed that Drs could wear smart watches and touches patients with no one against it.

*“So, ehmm yes, actually, there is something that stands out for me, ehmm what I don’t like is that there are some things that don’t make sense, ehmm like you will be asked to not wear our smart watches, so these are specifically made to be exposed to water, and once we are done with assisting, we wash our hands, and our watches. So we are expected to remove our watches, but we can wear wedding rings, year so I’m not sure how can this be any different from each other. Yah” (Participant EN).*

*“Even the Drs will wear their watches and come to the theatre and even touch the patient, but nobody tells them anything. So I feel that the rules must apply to everyone” (Participant SKC).*

Maharjan et al. (2014), carried out a study to identify the possibility of bacterial colonisation on personal adornments such as rings and watches, and found that there was higher bacteria on adorned hands than those that were bare. The discrimination experienced by the CPs, could be due to the attitude portrayed by doctors. A study by Mahommed and De Beer (2018), posits that although doctors including the trainees did not acknowledge infection control practices, it was clearly evident that the nursing managers at private hospitals found it difficult to approach doctors in order to alert them when they were not following infection control procedures (Mahommed & De Beer, 2018).

(b) Machine contributing to infection

Another unnecessary rule shared by the participants is that the machines used by them contribute to infection problems. Participants queried why this is a concern whilst it is allowed to bring beds from other wards into the theatre without sanitizing the wheels.

*“Yes there are some things like sometimes we are told that our machines contribute to infection problems, like when we wheel it in, but it is ok to bring the bed from other wards into a theatre without spraying down the wheels or anything, so in this instance I cant comprehend, also sometimes the ICU sends cables for us because we need t take the patient to ICU with monitoring on, and the cables are so dirty, so How can you have infection control when the very hospital doesn’t practice it in other wards and units” (Participant DJ).*

(c) Complaints against wearing long sleeves

Another concern that was shared was the prohibition against wearing long sleeves. In their own defence, the participants argued that they do not come in contact with patients and could not understand the motive for the rule. In a study conducted by Willis-Owen et al.(2010), with doctors assigned to bare below elbows (which is a term coined in theatre aimed at maintain hygiene of hands) and with those that were not, it was revealed that there was no statistical difference found between these two groups (Willis-Owen et al., 2010).

*“Oh my, most of the time, like one of the biggest thing for me is the long sleeves, I mean we don’t scrub for the procedures, but the sisters complain about us wearing long sleeves, and I have to tell you it’s really cold in theatre, But not just that, the nurses wear these big fleece jackets, so I’m not sure why they pick on us when the nurses can wear those jackets and while they are doing their anaesthetic work, and touching the patient and all” (Participant KC).*

Participant KP, whilst contributing to this, added that nurses wear jackets and cannot comprehend the logic of why long sleeves are prohibited in the theatre.

*“Yes sometimes, I must say the bare below the elbows thing, because I think I should be excluded from anything to do with the nursing staff. I mean we don’t have any direct contact with the patient. Oh also it doesn’t make sense because the nurses wear*

*jackets in theatre, so this doesn't make sense to me" (Participant KP).*

Participant SS and AG shared similar sentiments, particularly with the nurses wearing jackets in the theatre whilst at the same time, against clinical technologists wearing long sleeves.

*"Actually, sometimes they come up with new rules, like for example, they wear jackets which they bring from home, in theatre, because it's really cold, and we wear like a long-sleeved inner warmer, and they ask us to remove it, whilst those jackets are still on and they wear it from theatre to theatre but we are just confined to one theatre. Yes that I don't think makes sense, and it has always bothered me" (Participant SS).*

*"Yes, very often, I feel there's no logic. Like we can bring scrubs from our houses but we can't wear long sleeves in theatre but we can wear a jacket (Participant AG).*

(d) Prohibition against inner thermals

Like wearing long sleeves, Participant TH protested the logic against wearing inner thermals given the temperature in the theatre.

*"Yes, that definitely. There is one thing that I found never makes sense. Like why are we allowed to bring our scrubs from home, but we cannot wear inner thermals, It is very cold in the theatre, so I don't think it makes any sense to allow us to wear our scrubs from home but not our longs. It's not like we are in contact with the patient during the open procedure, so to me that definitely don't make sense" (Participant TH).*

(e) Eaten and drinking compliance

Another concern shared by the participants is the disproportionate interpretation of rules. For example, it was revealed that while eating and drinking is prohibited in the theatre, the nurses have been found drinking from personal water bottles, however, condemned the Cardiovascular Perfusionist and referring to them as being non-compliant if found with a water bottle. The Occupational Safety and Health Administration (OSHA) in the United States clearly prohibits healthcare staff from eating or drinking in theatre as it was found to contribute to the poor infection control practices in theatre (OSHA, 2019). However, no concrete studies have been found to show the significance in this matter.

*“Of course, most times, they say something, and I feel they contradict what they said, like one main issue for me is eating or drinking in theatre, we all know that we shouldn’t, then you see these nurses with their cucumber water in their Tupperware bottles, I mean really. And then in the middle of the case, they drink their water. Yes, so that irritates me” (Participant KP2).*

*“We mustn’t eat or drink in the theatre, but the nurses will walk around with their coffee cups and their water bottles. Sorry but don’t get me started” (Participant AG).*

## **4.8 Discussion**

While the World Health Organization and the Centres for Disease Control and Prevention have recently released guidelines for the prevention of surgical site infections (WHO, 2015), it is evident that , knowledge, attitude, and awareness of infection prevention and control measures are often inadequate and a great gap exists between the best evidence and clinical practice with regards to HAIs prevention.

This chapter had exhaustively highlighted the views gathered from Clinical Technologists specialising in Cardiovascular Perfusion on their knowledge, awareness and practices pertaining to hospital-acquired infections. From the interview, 5 themes were identified.

### **Theme 1**

Explored the participants understanding of infection control and prevention. It was uncovered that while participants had a good understanding of infection control, many, however, were not familiar with the hospital policies of infection control practices. Nevertheless, participants claimed to comply with infection control and practices and attributed their reasons to the duration of practice without any case of contamination reported from their work.

### **Theme 2**

Explored the knowledge of healthcare-acquired infection. It was uncovered that the common HAIs in cardiothoracic surgery include Carbapenem-Resistant Enterobacteriaceae (CRE), hepatitis, and virus, particularly Covid-19. It was also found

that patients most vulnerable to HAIs are those with poor immunity, and compromised immune system, comorbidities, diabetes, and hypertension.

### Theme 3

Explored the awareness of healthcare-associated hospital infection. It was found that touching the spike during instrument setting up could be a source of cross-contamination. Another critical concern of CPs is that the syringes that get handed to them may be a possible source of infection. It was also hinted that nurses and doctors could be a source of contamination. In reviewing the literature, it was found that this could occur through surgical attire (Health, 2019) worn by them or inappropriate handling of gloves. Cardiovascular Perfusionists seem to also have vast knowledge of airborne pathogens. Interviews with the participants, however is suggestive, that their actions in theatre has posed no life threatening post-operative infection.

### Theme 4

Explored the Cardiovascular Perfusionists practice. It was found that none of the participants were directly involved in the inserting of CVP or catherization. Participants only contribution in the procedure was the setting up of the transducers and then connecting the monitoring device.

### Theme 5

Explored the precautions to follow in cardiothoracic surgery. A critical concern uncovered in this theme was that there is inadequate provisions in place for the disposing of post bypass blood soiled items. From this theme, it was uncovered that participants were concerned about the lack of waste management considered for bypass procedures.

Subsequently, there was concern regarding the prohibition of wearing smartwatches, long sleeves, and inner thermal. From previous literature exposed in this study, it is evident that there is a lack of knowledge with regard to the matters pertaining to theatre etiquette along with health worker discrimination which requires further investigation and research. Mahommed and De Beer (2018), explains that in correlation to poor infection control compliance is the lack of infection control training at the tertiary institutions. The similar pattern is reflected in the excerpts taken from the interviews.

This study was significant since it examined the knowledge and compliance to infection prevention and control, of Cardiovascular Perfusionists, which had never before been examined.

We have gained new knowledge and insights in the practices of CPs, and their understanding of infection prevention and control as well as the gaps in their knowledge. We now have an understanding of their barriers when it comes to compliance, particularly the mindset that they are singled out or related to infection transmission. It is also clear that there is a lack in the facilitation of disposal of medical waste which contributes to the understanding that Cardiovascular Perfusionist, are therefore, knowledgeable in the matters of cross contamination and airborne pathogens although not scientifically explained during their interviews.

Another key element or weakness to explore is that infection prevention and control as a subject has not been implemented at tertiary level in the Department of Health Sciences at the Durban University of Technology from where all the CPs received their training and education. The study has highlighted that practitioners are, therefore, being reliant on the knowledge of their predecessors and that of the nursing staff within the private facilities that they practice in.

We also cannot ignore that although the CPs did not receive any formal training or education in infection and prevention control practices, they were in fact compliant and most do follow the directives of the theatre regulations that are set out. The CPs, had also identified that the nursing staff themselves were not being compliant, in their approach to infection prevention and control, and are therefore conflicted in their thoughts of infection prevention and control.

*“We mustn’t eat or drink in the theatre, but the nurses will walk around with their coffee cups and their water bottles. Sorry but don’t get me started” (Participant AG).*



## **4.9 Limitations**

The limitations of this study is as follows:

Participants of this study were only based and resided in Durban in KwaZulu-Natal and those that practiced at a specific hospital, however, drawing from their interviews, sufficient data was able to be extracted.

In spite of the lack of research on infection control knowledge and compliance pertaining to Cardiovascular Perfusionist, studies concentrating on other health workers were valuable in the development of the interview questions.

Arranging interviews with the participants were challenging, as Cardiovascular Perfusionists spend most of their time in theatre and are, therefore, unable to participate in the interviews during the day. Most of the interviews were conducted in the evening or on the weekend.

Covid-19 also contributed to the challenges of setting up of interviews, as this study would have been a live interview, however, online instruments had to be used.

## **CHAPTER FIVE**

### **RECOMMENDATIONS AND CONCLUSION**

#### **5.1 Recommendations**

Drawing from the information retrieved in this study the following recommendations can be made:

- a) Tertiary institutions should make an effort in presenting a formal practical training module of infection control practices for Clinical Technologist in particular, Cardiovascular Perfusionists.
- b) Private Hospitals should play a more critical role in monitoring the infection control practices of all healthcare workers that transit the Operating Theatre environment.
- c) Private Hospital should also make infection control policies more accessible and available to extend to healthcare workers when necessary.

- d) The matter pertaining to indifference toward professionals need to be addressed.
- e) Once a training programme is established by the Tertiary Institutions then the programme should be regularly reviewed and updated according to the dynamic nature of research.

## **5.2 Conclusion**

This study demonstrated that most of the participants had good overall knowledge and understanding regarding infection control practices, although many felt that there exists an inequitable application of infection control policies due to professional biases. Cardiovascular Perfusionists, also exhibited compliance to infection control policies, regardless of how unreasonable they may have seemed.

Since nosocomial infections contribute significantly to the morbidity and mortality of hospitalised patients, it is therefore essential that all healthcare staff should be exposed to infection prevention and control training. Further research is suggestive to identify, following the infection prevention and control training, if healthcare workers have a positive attitude to the compliance thereof.

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## APPENDICES

### Appendix A: Letter of Information



#### LETTER OF INFORMATION MAIN STUDY

**Title of the Research Study:** Assessing infection control knowledge and compliance in theatre at a private hospital in KwaZulu- Natal, South Africa.

**Principal Investigator/s/researcher:** Elizabeth Laura Naidoo (Bachelor of Technology Clinical Technology, Cardiovascular Perfusion)

**Co-Investigator/s/supervisor/s:** Prof JK Adam (PhD, FABAP) AND Dr MK Odayan (MBCHB, FCS)

#### **Brief Introduction and Purpose of the Study:**

Dear Respected Practitioner, I trust this letter finds you well. I am a student registered for my Master's Degree in Health Sciences at the Durban University of Technology. I would like to invite you to participate in my research. Research is a systematic search or inquiry for generalized new knowledge. As you are aware, infection prevention is a crucial component to provide quality care in any health care setting. Infections are leading cause of death and preventable illness. This study framework was developed to find out the knowledge and practice among cardiovascular perfusionists, regarding infection prevention by means of an online interview. As you are aware of the current state of the global pandemic, online interviews will be in the best interest of both parties.

#### **Outline of the Procedures:**

The interview will be approximately 25 minutes long and will be recorded for the purpose of the study. The expected outcome from these interviews is to determine the efficiency of the data collect process within this research study. The interview will be conducted in a secure and private location and thus confidentiality will be maintained. This interview process will be conducted by myself, and the private practitioners chosen for the study who are Cardiovascular Perfusionists with a BTECH Degree.

#### **Risks or Discomforts to the Participant:**

There are no risks involved in this study

#### **Benefits:**

The outcomes of the research will improve patient care at private healthcare facilities and lower costs to patient and hospitals by improving patients, post-operative outcomes. Identifying any shortcomings in infection prevention practices may have the potential to influence constant improvement in infection control practices and protocols.

**Reason/s why the Participant May Be Withdrawn from the Study:**

Participation is totally voluntary, and you may withdraw from the research study at any time and for any reason. There will be no adverse consequences for withdrawal.

**Remuneration:**

There is no remuneration for participating in the research study.

**Costs of the Study:**

There are no costs to you in participating in this study.

**Confidentiality:**

All the information collected will be kept confidential. You will be allocated a code and all details will be recorded under that code. This means that anyone who looks at my records will not be able to trace it to you. There will be no way of identifying participants in this study. The data collected will be stored in a locked secure room in the department that is password protected and data will be destroyed after 5 years as per DUT rules.

**Research-related Injury:**

There is no risk or research-related injury or adverse reaction is anticipated.

**Persons to Contact in the Event of Any Problems or Queries:**

Please contact the researcher Ms E.L.Naidoo (0837784324), my supervisor Prof JK Adam (0827860682) or the Institutional Research Ethics administrator on 031 373 2375. Complaints can be reported also to Prof S Moyo (Deputy Vice Chancellor: Research Innovation and Engagement) on 031 373 2326.



## Appendix B: Consent to Participate



### CONSENT : MAIN STUDY

#### Assessing infection control knowledge and compliance in theatre at a private hospital in KwaZulu- Natal, South Africa.

- I hereby confirm that I have been informed by the researcher, E.L.Naidoo, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: IREC I 05/20,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during this research which may relate to my participation will be made available to me.

\_\_\_\_\_  
**Full Name of Participant**                      **Date**                      **Time**                      **Sign /Right Thumbprint**

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

\_\_\_\_\_  
**Full Name of Researcher**                      **Date**                      **Signature**

\_\_\_\_\_  
**Full Name of Witness (If applicable)**                      **Date**                      **Signature**

\_\_\_\_\_  
**Full Name of Legal Guardian (If applicable)** **Date**                      **Signature**

## Appendix C: Interview Guide



### Knowledge and compliance to infection control practices

Interview guide

Fact Sheet Information

- Pseudo Name, Age, Gender and Type of Perfusionist (if specialising in a certain area)

Research Problem

This qualitative research aims to assess infection control knowledge and compliance in theatre at a private hospital in KwaZulu- Natal, South Africa.

-

Research Questions

- The questions are merely a guide for a semi structured interview with 12 perfusionists.

Grand Tour Questions

- Please can you state your highest qualification and what category did you specialize in
- Can you share with me your understanding and knowledge of infection prevention and control practices?
- Have you ever been to an infection prevention and control training programme when you began your profession? If so, how long ago? Or how often?
- Being in private practice, have you made yourself familiar with each hospital's infection control and prevention protocols? If so, how long ago
- Can you tell me anything about hand hygiene or relevance of hand wash with regards to your practice in a cardiac theatre or any other theatre that may require your services? Eg. how often do you wash your hands and when?
- Are you able to provide give examples of HCAs.
- What is the most effective method of preventing and controlling healthcare-associated infection (HCAI)?
- Which patients in your opinion are most vulnerable to HCAI and why do you think so?
- During the setting up of your pump what precautions do you take to avoid HAIs. How do you ensure that the bypass circuit is set up in an aseptic manner?
- Do you wear protective gear during surgical procedures? (eg, apron, gloves, goggles/visor) Is it made readily available to you? Are you aware of any methods that exist to avoid HCAI?
- Are you aware of the risks related to HCAI?

- What are the possible risks of cross contamination during CPB in the operating theatre during a cardiac procedure?
- Are you aware of any patients post op cardiopulmonary bypass procedures or any other surgical intervention procedure, contracting a HAI? And what was the outcome?
- Do you think that there is anything that you have done that may have ever contributed to post op infections?
- Are you involved in the CVP procedure? If so how and please explain the manner in which you assist.
- Are you involved in any urinary catheterization? If so, how?
- Do you comply with the policies of infection control in the theatre? or do you find yourself questioning any infection control practices in theatre? If so, what are they? And why would you disagree with some of the policies

## Appendix D: Ethics Approval



**Institutional Research Ethics Committee**  
Research and Postgraduate Support Directorate  
2<sup>nd</sup> Floor, Berwyn Court  
Gate 1, Steve Biko Campus  
Durban University of Technology  
P O Box 1334, Durban, South Africa, 4001  
Tel: 031 373 2375  
Email: [lavishad@dut.ac.za](mailto:lavishad@dut.ac.za)  
[http://www.dut.ac.za/research/institutional\\_research\\_ethics](http://www.dut.ac.za/research/institutional_research_ethics)  
[www.dut.ac.za](http://www.dut.ac.za)

9 March 2021

Ms E L Naidoo  
20 Margaret Crescent  
Forest Hills  
Kloof

Dear Ms Naidoo

**Assessing infection control knowledge and compliance in theatre at a private hospital in Kwa-Zulu Natal, South Africa**

I am pleased to inform you that Full Approval has been granted to your proposal.

The Proposal has been allocated the following Ethical Clearance number **IREC 105/20**. Please use this number in all communication with this office.

Approval has been granted for a period of **ONE YEAR**, before the expiry of which you are required to apply for safety monitoring and annual recertification. Please use the Safety Monitoring and Annual Recertification Report form which can be found in the Standard Operating Procedures [SOP's] of the IREC. This form must be submitted to the IREC at least 3 months before the ethics approval for the study expires.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC SOP's.

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely

Professor R Bhagwan  
Chairperson: IREC (Acting)

## Appendix E: Turnitin Report

## Laura

### ORIGINALITY REPORT

<b>7</b> %	<b>4</b> %	<b>4</b> %	<b>4</b> %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

### PRIMARY SOURCES

<b>1</b>	<a href="http://ujcontent.uj.ac.za">ujcontent.uj.ac.za</a> Internet Source	<b>1</b> %
<b>2</b>	Submitted to Mancosa Student Paper	<b>1</b> %
<b>3</b>	<a href="http://infectionsinsurgery.org">infectionsinsurgery.org</a> Internet Source	<b>&lt;1</b> %
<b>4</b>	"Meeting abstracts from International Conference on Prevention & Infection Control (ICPIC 2017)", Antimicrobial Resistance & Infection Control, 2017 Publication	<b>&lt;1</b> %
<b>5</b>	<a href="http://www.ncbi.nlm.nih.gov">www.ncbi.nlm.nih.gov</a> Internet Source	<b>&lt;1</b> %
<b>6</b>	Mohammad S. Alyahya, Heba H. Hijazi, Jumana Al Qudah, Suher AlShyab, Wedad AlKhalidi. "Evaluation of infection prevention and control policies, procedures, and practices: An ethnographic study", American Journal of Infection Control, 2018 Publication	<b>&lt;1</b> %