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KNOWLEDGE OF NEPHROLOGY NURSES ON EVIDENCE BASED GUIDELINES FOR PREVENTION OF HAEMODIALYSIS CATHETER RELATED INFECTIONS

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A research report submitted to the
Faculty of Health Sciences, University of the Witwatersrand, Johannesburg
in partial fulfilment of the requirements for the degree
of
Master of Science in Nursing

Johannesburg, 2016

DECLARATION

I, Mphanye Joseph Ntlhokoe, declare that this research report is my own work. It is being submitted for the degree of Master of Science (in Nursing) at the University of the Witwatersrand, Johannesburg. It has not previously been submitted for any degree or examination at this or any other university.

Signature …….

……day of …… 2016

Protocol Number **M130921**

DEDICATION

Special dedication to my family for their inspiration, love and support throughout my studies at the University of the Witwatersrand, Johannesburg.

Many thanks to all the Nephrology nurses who participated in my study and the expertpanel who agreed on and validated my research tool.

ACKNOWLEDGEMENTS

I thank God for provision and protection throughout my study; I owe nothing to myself.

My gratitude goes to the following people and institutions:

To my wife, Mpho Ntlhokoe and my family for their tireless support throughout my study.

To my supervisor Shelley Schmollgruber for her guidance, total support and motivation. Sincerely you were not only a supervisor to me but also a mentor. A big thank you to you.

To the Wits biostatistician for their statistical analysis and interpretation of the data.

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To the institution where the research was carried out and the relevant personnel of this institution.

To the Nephrology nurses who participated in this study and their families, thank you for making this study possible.

ABSTRACT

The purpose of the study was to determine knowledge of nephrology nurses' on evidence based guidelines for the prevention of haemodialysis catheter related infections. The study was done in 5 haemodialysis units from two university-affiliated, public sector and tertiary level hospitals in Gauteng which are: "Baragwanath Hospital and Charlotte Maxeke Academic Hospital".

Face and content validation of the research instrument *"Evaluation questionnaire concerning nurses' knowledge of interventions for prevention of haemodialysis catheter-related bloodstream infections"* was done by a panel of experts to ensure applicability of the instrument to the South African context. Prior to commencement of the study, ethical clearance and permission to conduct the study was obtained from the relevant authorities and the university committee. A non-experimental, descriptive, prospective study design was utilised in order to meet the objectives of the study. Descriptive and comparative statistics were used to analyse the data which was done in consultation with a statistician.

Knowledge was reorganised as poor (0-50%), average (50-70%) and good (71% and above). Overall, participants performed well in the second part of the questionnaire where their knowledge was tested regarding evidence based guidelines in prevention of vascular access infection; the majority 72.50% (n=58) scored more than 71%, indicating they have knowledge of evidence based guidelines on prevention of vascular access infection, 20% of participants scored between 51 and 70%, whilst only 2% scored below 50%.

A positive correlation (with moderate strength) between age and experience (r=0.563) was established indicating that as age increases the experience will also increase moderately. A slight negative correlation, which was very weak (null correlation) was also established between years of experience and performance as most respondents were above and below the regression line. Therefore years of experience has no influence over performance.

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LIST OF ABBREVIATIONS

The following is a list of abbreviations used in the study:

AVF	Arteriovenous Fistula
AVG	Arteriovenous Graft
CDC	Centre for Disease Control and Prevention
CRBSI	Catheter Related Bloodstream Infection
CVC	Central venous catheter
ERA	European Renal Association
HPSC	Health Protection Surveillance
ICU	Intensive Care Unit
NKF-KDOQI	National Kidney Foundation Kidney Disease Outcomes Quality Initiative
RRT	Renal Replacement Therapy
UK	United Kingdom
USA	United States of America

CHAPTER ONE

OVERVIEW OF THE STUDY

1.0 INTRODUCTION

This chapter presents an overview of the study. The problem statement, purpose of the study, research objectives and the significance of the study will be described, the assumptions of the researcher will be discussed and operational terms defined. A brief overview, which will be discussed in greater detail in chapter three, will be given of the research methodology, validity and reliability and the ethical principles adhered to.

1.1 BACKGROUND OF THE STUDY

Chronic kidney disease is recognised as a worldwide public health problem (Kara, 2009; Yu & Petrini, 2010). It causes significant increase in the mortality, morbidity, decreased quality of life and burden on the healthcare expenditure (Kara, 2009). Yu and Petrini (2010) reported that chronic kidney disease continues to increase due to increase in the hypertension and diabetes. This is a slow and long-lasting loss of kidney function and the progress of the disease is categorised into 5 stages with the last stage being referred to as end stage kidney disease. It is at this stage where a patient is expected to start renal replacement therapy (RRT), which can be either haemodialysis or peritoneal dialysis. A small number of these patients may be offered the option of renal transplantation (McCann & Moore, 2010).

Globally, there is an increase in the number of patients who need renal replacement therapy each year and haemodialysis is the most common means of treatment (Murphy, 2011). In the United States of America (USA) about 90% of patients receive haemodialysis and 80% in the United Kingdom (UK), while the number of patient receiving haemodialysis in the Republic of Ireland is increasing nationally (Murphy, 2011). While Yu and Petrini (2010) reported that in China about 96-100 people per millions advances to end stage kidney disease and the number is growing by about 130, 000 each year and went further to say that there were 41, 755 (89.5% haemodialysis and 10.5% peritoneal dialysis)

of patients requiring dialysis in 1999 as reported by the Chinese 1999 Registry of Dialysis and Transplantation (Yu & Petrini, 2010).

According to the American Kidney Fund (2012), about 31 million people developed chronic kidney disease in the USA (approximately 10% of the total US population). This report highlights that in 2009, about 116,395 of people were newly diagnosed with kidney failure while about 571 414 had already been living with the disease and it was reported that 90 118 people had already lost their lives due to the disease (most recent stats available). In 2009, 398 861 people were on dialysis and haemodialysis accounts for 95% of all people on dialysis (380 760), whilst 5% (18 101) were on peritoneal dialysis and the expenditure by Medicare for people with chronic kidney disease totalled $33.8 billion (American Kidney Fund, 2012).

Africa is the second largest continent, with 53 countries and approximately 1 billion people comprising 14% of the world's population. Sub-Saharan Africa has 45 countries, with a population of 389 million, where the majority (80%) live on less than $2.5 per day. Naicker (2013) stated there is an increasing need for kidney health care and renal replacement therapy in Africa as in the rest of the world, but only a few countries have the ability to care for the needs of all patients. According to Naicker (2013) dialysis and transplant patients use an increasing proportion of the total health budget in countries such as Taiwan, Japan and United States, whilst the majority of emerging countries, such as African nations, have limited resources of these expensive treatments. In addition, there is a lack of renal registries and no reliable statistics on the prevalence of chronic kidney disease in most African countries (Naicker, 2013).

Of those patients commencing haemodialysis, 70% are admitted for temporary vascular access which carries a significant risk in complications, such as infections, which leads to an increase in morbidity and mortality (Murphy, 2011). Vascular access infections are the second leading cause of morbidity and mortality in patients receiving haemodialysis (Strong & Mukai, 2011). Hand hygiene, use of protective clothing and face shields, vascular access cleaning and dressing are measures used to minimize risk of infection and forms an integral part of vascular access care and hygiene (Higgins & Evans, 2008). For patient safety nurses should possess sufficient knowledge on infection control measures and to be able minimize infection in the haemodialysis units (Higgins & Evans, 2008).

Guidelines for prevention of intravascular catheter-related bloodstream infections were developed by Centre for Disease Control and Prevention (CDC) (CDC, 2011), European Renal Association (ERA) (ERA, 2012), and National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-KDOQI) (NKF-KDOQI, 2012) and the Health Protection Surveillance Centre (HPSC) (HPSC, 2005) for healthcare personnel working with intravascular catheters. It is therefore the role of nephrology nurses to have the necessary knowledge, skills and education on these guidelines for the prevention of infection in renal dialysis units (Higgins & Evans, 2008).

There are different types of haemodialysis vascular access methods, namely: arteriovenous fistula, arteriovenous graft, and central venous catheter. In more than 80% of patients starting haemodialysis, the route of choice is the central venous catheter which has many advantages such as ease of insertion, unnecessary maturation time and can be used immediately without disadvantages. However, the central venous catheter carries a substantially higher morbidity and mortality rate than the fistulas and grafts (Mokrzycki & Lok, 2011). All three of these vascular access methods require highly specialized nursing techniques and skills to ensure patient safety. Kidney failure patients are high risk patients because they are not only compromised by electrolyte and metabolic disturbances, but also by immune-deficiencies and other comorbid conditions such as human immune virus (HIV) (Bedendo, Giarola & Brondani, 2011).

Research showed a significant rate of vascular access infections in patients by new or inexperienced dialysis staff. This might be due to nurses being insufficiently trained in accessing the patient's circulation and may not follow the correct arteriovenous access techniques, or apply the infection control procedures, or adhere to the standards in sterile catheter care. To prevent these life-threatening malpractices, training and competency assessment of nursing personnel needs to be regularly assessed and recorded, and there should be on-going professional development (Dorman & Dainton, 2011). This study therefore proposed to investigate nephrology nurses' knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related bloodstream infections.

1.2 PROBLEM STATEMENT

Dialysis catheter related infection remains a concern in patients with kidney failure and most deadly form of health related infections. Adherence to evidence-based guidelines on prevention of haemodialysis catheter-related infection would reduce its risk of occurrence and decrease morbidity and mortality of haemodialysis patients in the renal dialysis units. Research has demonstrated an increased rate of vascular access infections in patients by new or inexperienced dialysis staff. This might be due to nurses being insufficiently trained in accessing the patient's circulation and may not follow the correct arteriovenous access techniques, or apply the infection control procedures, or adhere to the standards in sterile catheter care. For patient safety nurses should possess sufficient knowledge on infection control measures and to be able minimize infection in the haemodialysis units.

This study will attempt to answer the following research questions:

- Do nurses have knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related bloodstream infections?
- Are the evidence-based guidelines for prevention of haemodialysis related bloodstream infections being practiced in the renal dialysis units and if not, what are the reasons for non-adherence to the evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections?
- Does training and years of experience in renal care influence knowledge levels of nephrology nurses?

1.3 PURPOSE OF THE STUDY

The purpose of this study was to investigate nephrology nurses' knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related bloodstream infections in the renal dialysis units from two university-affiliated, public sector and tertiary level hospitals in Gauteng.

1.4 OBJECTIVES

The objectives of this study are:

- To validate the instrument *"Evaluation questionnaire concerning nurses' knowledge of interventions for prevention of haemodialysis catheter-related bloodstream infections"* to assess nurses' knowledge on evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections.
- To determine and describe nephrology nurses' knowledge of evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections in the renal dialysis units from the public sector institutions in Gauteng.
- To establish whether there is a relationship between age, years of experience and knowledge of nurses (trained and non-trained) on evidence-based guidelines of haemodialysis catheter-related infections.

1.5 SIGNIFICANCE OF THE STUDY

Haemodialysis catheter-related bloodstream infection carries high morbidity and mortality rates worldwide. There is evidence to support various strategies that helps prevent its incidence. Evidence-based guidelines have been created in the prevention of haemodialysis catheter-related infections and adherence to these guidelines is extremely important in increasing positive outcomes for haemodialysis patients in the renal dialysis units. Lack of knowledge has been indicated as a barrier for adherence to evidence-based guidelines. Therefore it is important to evaluate nephrology nurses' knowledge and to highlight possible causes which prevent implementation of evidence-based guidelines on prevention of haemodialysis catheter-related bloodstream infections, which is what this study aimed to achieve.

1.6 RESEARCHER'S ASSUMPTIONS

This is based on a paradigm, which according to De Vos, Strydom, Fouche and Delport (2013), is a framework, viewpoint or worldview based on assumptions and philosophies of people's social world. This study was based on the following meta-theoretical, theoretical and methodological assumptions.

1.6.1 Meta-theoretical Assumptions

Meta-theoretical assumptions are statements that are not intended to be tested by the study. The meta-theoretical assumptions of nursing comprise the person, environment, health and nursing, particularly related to the speciality of Nephrology nursing.

1.6.1.1 Person

A person in this case will refer to a patient, renal nurses and doctors. A patient with a diagnosis of kidney failure is an individual with physical, psychological, social and spiritual needs and dependent on the competencies of a nephrology nurse to meet their needs. Family members play a supporting role and influence and enhance nurse-patient relationships.

1.6.1.2 Environment

Environment refers to a surrounding that influences a person's physical, emotional and psychological well-being, it can be internal and external, positive or negative in respect of all the circumstances influencing and impacting on behaviour of the person. In this study the environment will be the renal dialysis unit. The renal dialysis unit is a complex area with high technology and this is unfamiliar to patient and can be a source of stress to the patient and their families.

1.6.1.3 Health and wellness

Health refers to as a state of complete physical, mental and social wellbeing and not merely an absence of disease. Dialysis as a treatment modality is aimed at improving quality of life of kidney failure patients so that they can live a near normal and productive life.

1.6.1.4 Nephrology nursing

A kidney failure patient is dependent on the competency and knowledge of a nephrology nurse to provide holistic quality care in a safe and healing environment; and act as a link

between patient and technology that maybe complex and threatening to ensure patients' health care needs are met.

1.6.2 Theoretical Assumptions

A theory is an explanation of a phenomenon and its relationship between variables that are related to the phenomenon (De Vos, et al., 2013). This also includes the operational definition of terms used in the study:

1.6.2.1 Operational definitions

- **Patient**

A patient is described as the recipient of care from health care professionals (Booker, Waugh, van Rooyen, Jordan & Kotze, 2009). Within this study, a patient will refer to a recipient of care from a professional nurse within the renal dialysis unit while receiving haemodialysis.

- **Renal dialysis unit**

A renal dialysis unit is a specifically staffed and equipped hospital unit. The management is dedicated to patients with all forms of kidney failure: patients spend about four to five hours on a dialysis machine, three times a week. There are different shifts each and changes per day – one in the morning, afternoon and evening and perhaps a night shift. There is always a member of staff in the unit to deal with any difficulties a patient may have and to ensure they are as comfortable as possible (Freshwater & Prothero, 2004).

- **Haemodialysis**

Haemodialysis is a medical treatment for the removal of fluid and waste products from the blood to correct electrolyte imbalance, which is accomplished by using a machine and a dialyser, also referred to an artificial kidney. It is used to treat both acute and chronic kidney disease. Thus it is also considered a life sustaining treatment (Gomez & Castner, 2015).

- **Vascular access device**

A vascular access device (VAD) is defined as an indwelling catheter, cannula, or other instrument used to obtain venous or arterial access (Mosby's Medical Dictionary, 2009), Three are three types of vascular access devices: namely arteriovenous graft, arteriovenous fistula and central venous catheter.

In this study the terms *"vascular access device"* and *"central venous catheter"* are used *synonymously*.

- **Central venous catheter**

A central venous catheter (CVC) is a catheter inserted into a centrally located vein with the tip residing in the vena cava or right atrium; permits intermittent or continuous infusion/and or access to the venous system (CDC, 2011). The same definition was applied to this study.

- **Catheter-related bloodstream infection**

A catheter-related bloodstream infection (CRBSI) refer to the presence of bacteraemia or fungaemia in a patient with an intravascular catheter with at least one positive blood culture obtained from a peripheral vein, clinical manifestations of infection (e.g. fever, chills and/or hypotension, and no apparent source for the bloodstream infection except the catheter (CDC, 2011). The same definition was used in this study.

- **Nephrology Nurse**

A nephrology nurse is a clinical nurse who functions at an advanced level of patient care in a multi-disciplinary nursing environment; s/he may be formally trained – a registered nurse with no formal Nephrology qualification, or formally trained.

According to the South African Nursing Council (SANC), a nephrology nurse is a registered nurse who obtains a post basic qualification in medical-surgical; Advanced

Medical Surgical Nursing: Critical Care (R212 of 1983 and amended: 119:2). In this study, a nephrology nurse is one who has had formal training at a SANC approved learning facility (university or college) under R212 or informal training through orientation and in-service training.

In this study, the term *"trained nurse*" is synonymously applied to a nephrology nurse.

- **Professional Nurse**

A professional nurse is an individual who is registered under Section 16 of the Nursing Act 33 of 2005. In this study, this person is a nurse who has received educational training at a SANC approved nursing school and has successfully completed the requirements for registration with the South African Nursing Council (R425/R284, as amended, 1985:2) but with no formal training in nephrology nursing.

In this study the term professional nurse is synonymously referred to as an *"untrained nurse"* meaning that the professional registered nurse has not obtained a post basic qualification in nephrology nursing.

- **Evidence-based practice guidelines**

Evidence-based practice guidelines are systematically developed statements derived from randomised control studies based on best research evidence of clinical effectiveness which assists clinicians and patient decision making about appropriate measures for specific circumstances (Muscedere, Dodek, Keenan, Fowler, Cook & Heyland, 2008).

For this study, the evidence-based guidelines referred to was derived from literature and recommendations from the *"Guidelines for the prevention of intra-vascular catheter-related infections"* (Centre for Disease Control and Prevention [CDC], 2011).

- **Knowledge**

Knowledge is set to be a complex and multi-faceted concept; it is defined as familiarity with something and can include information, factors of skills acquired through education or experience (Oxford Dictionary, 2007). In the same dictionary, it can also refer to both practical and theoretical understanding of a subject and explicit (theoretical understanding of a subject) or implicit (practical skill or expertise) acquired through personal experience, role-modelling and mentorship, intuition, reasoning and research (Grove, Burns & Gray, 2013).

In this study, knowledge of nurses will be assessed from the strategies/items derived from the *"Guidelines for the prevention of intra-vascular catheter-related infections"* (Centre for Disease Control and Prevention [CDC], 2011).

1.6.3 Methodological Assumptions

Methodological assumptions reflect the researcher's assumptions about the nature of the research process. The methodological assumptions guiding this study are in line with the scientific method of inquiry, which proposes that the dimensions of the research process following step by step, starting with the problem statement, objective, paradigmatic perspective, considering ethical measures, research design and method up to writing the report and lasting publications of results (Burns & Grove, 2009).

The researcher believes in nursing as a holistic approach to patient care which includes patient's aspects of physical, mental, social and spiritual. A patient as a whole must be considered in the delivery of care. Nursing care is an integration of knowledge, skills experience and individual attributes. Clinical judgment is based on skills acquired through the process of integrating education, experiential knowledge and evidence-based guidelines.

The researcher believes that nursing as a science relies heavily on evidence-based practice. Evidence-based practice is the integration of the best available external clinical evidence-based from systemic research with individual clinical expertise and patient values to facilitate decision making (Bakke, 2010). The purpose of the research is to establish

knowledge possessed by nephrology nurses on evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections.

1.7 OVERVIEW OF THE RESEARCH METHODOLOGY

The research methodology refers to the blueprint that guides the study to have control over factors that could interfere with the desired outcome (Burns & Grove, 2009). An overview of the research methodology used in the study is provided in the next section, which will be discussed in greater detail in chapter three.

A non-experimental, quantitative, descriptive and cross-sectional design was used to achieve the objectives of the study. The study respondents were nephrology trained and registered nurses affiliated to renal dialysis units at two major university-affiliated, public sector hospitals and tertiary level institutions in Johannesburg, using a self-administered questionnaire developed by the Centre for Disease Control and Prevention (CDC, 2011).

Ethical clearance and permission to conduct the study was sought from the relevant University Research Committees, the Department of Health and the hospitals. Participation in the study was voluntary and respondents were free to withdraw at any point in time. After permission was granted by the hospital and dialysis unit nurse managers, written consent was obtained from the nephrology nurses who agreed to participate in the study.

Descriptive statistics were used to analyse the data. The statistical software package Statistica™ version 12 was used for data analysis. Reliability of the study was maintained by ensuring the principal researcher was the sole collector of data, the sample size was achieved purposively and the data was verified by a biomedical statistician to ensure accuracy of the findings. Validity of the research was achieved by ensuring the data collection instrument was verified by nephrology clinicians to fit into the South African context.

1.8 RELIABILITY AND VALIDITY

A pre-testing process was conducted and validity scores were measured to ensure feasibility of the study and to detect possible flaws in the instrument used. Content validity

was achieved by having the data collection instrument reviewed by an expert panel of specialists in nephrology nursing. A prospective study will allow for investigation of unusual or unexpected results during data collection and investigate possible causes that yield such results.

Reliability was maintained by ensuring consistency and precise recording of information. Data collection was done by the principle researcher. An appropriate sample size was discussed with a statistician so as to be representative of the population under study, taking into possible refusal rates. Sample inclusions and exclusion criteria were adhered to.

1.9 ETHICAL CONSIDERATIONS

The following ethical requirements were taken into consideration for this study.

- Research proposal was presented to the University Postgraduate Committee for permission to conduct the study.
- Application was made for clearance to conduct research to the Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand.
- Application was made for permission to conduct the study to the Hospital Management.
- Permission to use the instrument was *not requested* as this was drawn from an open source document entitled *"Guidelines for the prevention of intra-vascular catheter-related infections"* (Centre for Disease Control and Prevention [CDC], 2011).
- To ensure confidentiality and anonymity of the participants code numbers were used during data collection and reporting.
- Participants were informed that participation in the study was voluntary and participants may decline to answer any particular questions as well as discontinue participation in the study at any time without incurring any penalty.

1.10 SUMMARY

This chapter has presented an outline of the study. The problem statement, purpose of the study, the research objectives and the study has been described. The assumptions of the researcher have been discussed and the operational terms defined. A brief overview has

been given of the research methodology, validity and reliability of the study and the ethical procedures adhered to.

The following chapters will include a review of the literature, the methodologies, data analysis, the description and interpretation of research findings. The final chapter will present limitations of the study, as well as summary of the study findings, conclusions and recommendations for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will discuss the literature reviewed in relation to the topic under study. It will cover the definition of catheter related infection, prevalence, pathology and pathogenesis, current protocols, evidence based practice and guidelines to prevent blood stream infections and current studies assessing knowledge. The literature review will help the researcher to build a legal framework for the study and set it in tradition of enquiry and context of related studies (De Vos, et al. 2013).

2.2 OVERVIEW OF HAEMODIALYSIS

Haemodialysis is described as the artificial process of eliminating metabolic waste products (diffusion) and unwanted water (ultrafiltration). It may be used for patients who have become ill and have acute kidney failure (temporary loss of kidney function), or for fairly stable patients who have permanently lost kidney function (stage 5 chronic renal failure). **Figure 2.1** shows a process whereby the blood is pumped through a semipermeable membrane by the haemodialysis machine in order to remove metabolic waste products, unwanted water and toxins from the body.

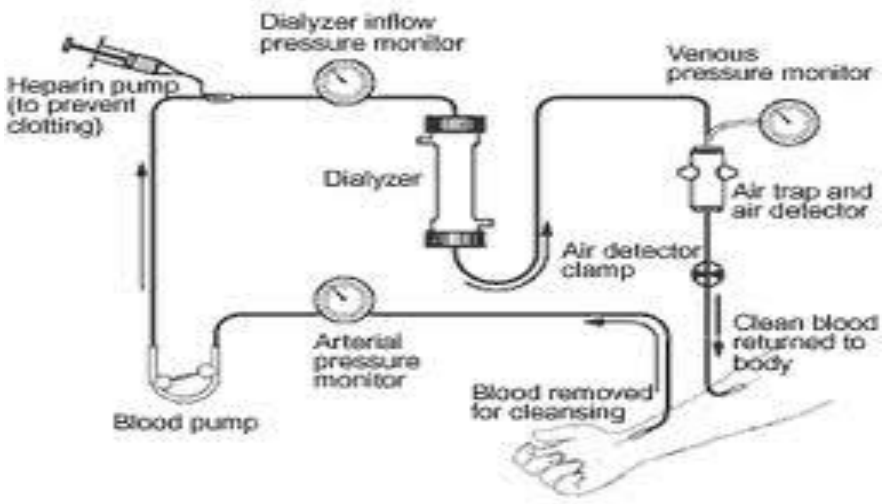


Figure 2.1 Haemodialysis (Sourced: www.kidney.nib.gov/kudisease/pubs/haemodalysis)

2.3 END-STAGE KIDNEY DISEASE

2.3.1 Prevalence

According to McCann, Clarke, Mellotte and Plant (2013) in Ireland about 30-40% patients per million of population is a predicted annual growth of patients with end stage kidney disease. Haemodialysis was selected by 80% (n=330) of new end-stage kidney disease as their treatment modalities in Ireland in 2011, while 1 557 of patients received haemodialysis. Establishment of vascular access to enable patient to undergo dialysis is an important part of haemodialysis.

Arteriovenous fistula is regarded as the golden standard globally in vascular access, haemodialysis patients with central venous catheter in particular are at risk of health care-associated infections, they have high episodes of vascular access bacteraemia when compared with arteriovenous fistula. These patients experience a deep impact on their health by these infections and can lead to serious illness, longer hospital stay, long term disability and death (McCann, et al. 2013).

According to Amato-Palumbo, Kaplan and Feinn (2013) the major impact on United States health system is kidney disease which is increasingly becoming a global health care crisis. The second highest prevalence of end stage kidney disease in the world is in the United States. There were 598,311 of patients with end stage kidney disease between 2009 and 2010 in the United States and majority of those patients were on haemodialysis.

2.4 OVERVIEW TO CATHETER RELATED INFECTION

Amato-Palumbo, Kaplan, Feinn and Lalia (2013) reported that about 3.2% of haemodialysis patients develop a dialysis access-related infection every month. Vascular access-related infection causes range of morbidities from local infection to sepsis and death.

Information received from 1,545 hospitals in 48 states and the District of Columbia (as reported by CDC, 2011) which works with monitoring infection surveillance in intensive care units/ or non-intensive care units highlighted that infections are influenced by many

factors such as severity of illness, type of illness, catheter related and institutional factors (CDC, 2011).

Haemodialysis patients are at great danger of having vascular access infection as a result of uraemia, exposure to nosocomial infection from hospitalization and break in skin defence. 50-73% of bacteria in the haemodialysis patients are caused by vascular access site and this can lead to meningitis, endocarditis, septic emboli, osteoarthritis and death (Higgins & Evans, 2008).

2.4.1 Definition of Catheter related Infections

A catheter related bloodstream infection is defined as an infections caused by bacteremia or fungaemia in a patient with an intravascular catheter in situ, and experience of one of the following: positive blood culture taken from a patient peripheral vein, clinical sign of infection (chills, fever and hypotension) and no other visible source of blood stream infection besides the catheter (http://www.safecarecampaign.org.crbsi).

A diagnosis of a bloodstream infection is made when a central venous catheter (central line) has been inserted for more than 48 hours prior to the growth of the infection. Time interval of more than 48 hours provides compelling evidence that the infection is related to a central venous catheter (http://www.safecarecampaign.org.crbsi).

A diagnosis of a catheter related bloodstream infection is made by accompanying signs of local or systemic inflammation such as fever, chills, hypotension and purulence around the insertion site of an intravascular device. Insertion of one extra intravascular catheter is needed for performing renal replacement therapy however introduction of organisms through the hub and lumen of the dialysis catheter puts these patients at risk (Vandijck, Labeau, Secanell, Rello & Blott, 2009).

2.4.2 Incidence of Infection

Bacteremia and exit site infection complications incidences of catheter related episodes of bacteremia for a non-tunnelled central venous catheter, range from 1.4 to 8.3/1000 catheter days and 1.6 to 6.1/1000 catheter days for tunnelled central venous catheter. Number of

catheter related bacteremia is reported to be corresponding with the time the catheter has been inserted and the site it has been inserted in (McCann & Moore, 2010).

Central Venous Catheters

Long-term venous access in the form of a central venous catheter has been used with increasing frequency in the inpatient and outpatient settings to ensure long term access for patients receiving haemodialysis treatment. Central venous catheters can predispose a patient to bacteria or fungal micro-organisms as they interrupt the integrity of the skin (http://www.safecarecampaign.org.crbsi).

2.4.3 Pathophysiology

According to Goudet, Timsit, Lucet and Lepape (2013) pathophysiology is now plainly understood of catheter infection. Catheter tip colonization for short-term catheters arises during catheter insertion and less commonly by movement of skin organisms down the catheter track from insertion site during catheter maintenance. Major threat of short-term catheters is that the density of the micro-organisms of the catheter site insertion and the most effective preventive measures for infection is the skin antisepsis.

2.4.4 Risk Factors

Blood stream infections have been linked with numerous risk factors in patients receiving haemodialysis, *Staphylococcus aureus* through nasal colonization which appears to be common among haemodialysis as in the general population tend to put them at risk of blood stream infections, however the greatest danger of blood stream infection in this patients is getting haemodialysis via a central venous catheter (Lincoln, 2011).

Oral or Nasal secretions of the patients or healthcare workers may be the portal of exit, whilst direct contact or airborne such as oral, nasal secretions, patients' skin, healthcare workers hands, environment or contaminated infusate, may be the mode of transmission (Tilton, 2006).

2.5 TYPES OF VASCULAR ACCESS

"Vascular access is often referred to as the 'Achilles heel' or weak chain in haemodialysis adequacy, as optimal haemodialysis cannot be achieved without well maintained vascular access" (Murphy, 2011). It was reported that 25% of hospital admissions for haemodialysis was due to difficulties with vascular access and the key cause of morbidity is access failure. It is important therefore that there is an early referral for vascular access because without this, 75% of patients starting haemodialysis need to be admitted for temporary vascular access which can lead to complications such as infections, increased morbidity and even mortality (Murphy, 2011).

Arterio-venous fistula is the mostly used choice of vascular access for maintenance haemodialysis. A 65% increase in the number of arteriovenous fistula is recommended by Kidney Disease Outcome Quality Initiative and the National Kidney Foundation (McCann & Moore, 2010). Central venous catheters vascular access are considered inferior to other vascular access and in 2006, Kidney Disease Outcome Quality Initiative (McCann and Moore, 2010) recommended less than 10% prevalence rate. It has been reported by dialysis outcome, that 46% to 70% of European and Canadian end stage kidney disease patients commencing maintenance dialysis do so via central venous catheter despite recommendation. The dependence on central venous catheter is also reflected in the prevalence rate of 18% (Europe) to 34% (Canada). Late referrals to Nephrologists, delay in access formation, lack of sufficient time for an arterial venous fistula to mature, or an over increasing older end stage kidney disease population who experience higher rates of vascular disease and diabetes resulting in an inadequate vascular for arteriovenous fistula formation attributes resulting in over reliance on catheters (McCann & Moore, 2010).

Type of vascular access alone can cause patients death. The evidence is of one to three fold increases in the risk for infection-related death in patients dialysed with central venous catheter compared to arteriovenous fistula, as revealed by Choices for Healthy Outcome in Caring for End Stage Kidney Disease. McCann and Moore (2010) reported that Kidney Disease Outcome Quality Initiative guidelines state that "*infection complications associated with catheter use in haemodialysis patients contribute to making infections the second leading cause of death in patients with end stage kidney disease, although there are no specific statistics provided*"(McCann & Moore, 2010:3).

There are different types of haemodialysis vascular access methods, namely: arteriovenous fistula, arteriovenous graft and central venous catheter. Key characteristics of the vascular access devices will be briefly described (Murphy, 2011).

- **Arteriovenous fistula**

An arteriovenous fistula (AVF) which is considered an ideal haemodialysis vascular access approach involves anastomosing an artery to a vein by a surgical procedure thereby forcing arterial blood into the vein forming a sufficient blood flow which is enough for successful cannulation. It can be created on radial-cephalic, brachial-cephalic or brachial-basilic vasculature (Scales, 2010). However, not every patient can have an arteriovenous fistula due to diabetes, peripheral vascular diseases and being old (Murphy, 2011). According to Wasse, Hopson and Clellan (2010) an arteriovenous fistula is the desired access for hemodialysis due to its greater health benefits, adequate blood low, a lesser risk for infection and thrombosis and reduced danger of mortality and morbidity compared to both arteriovenous graft and central venous catheter.

- **Arteriovenous graft**

An arteriovenous graft (AVG) which has a high risk of infection and thrombosis involves a connection of a tube developed from synthetic or biological material placed subcutaneously between a vein and artery (Scales, 2010). It is usually used when an arteriovenous fistula cannot be created or when one has failed; it can be placed straight, looped or curved (Murphy, 2011).

- **Central venous catheter**

A central venous catheter (CVC) is used when patients have no options for other vascular access devices or in an emergency situation (Scales, 2010). One advantage is that it can be used immediately, catheters can be inserted either on the internal jugular, subclavian or femoral (Murphy, 2011). The preferred site of insertion is the right internal jugular vein followed by the left internal jugular vein under strict aseptic technique. Use of the central venous catheter is discouraged, even though they are beneficial on patients who have no other alternative vascular access options. According to Mokrycki and Lok (2010), central

venous catheter carries a substantially higher morbidity and mortality rate than fistulas and grafts.

Figure 1.2 shows a central venous catheter that is used mostly for patients receiving haemodialysis.

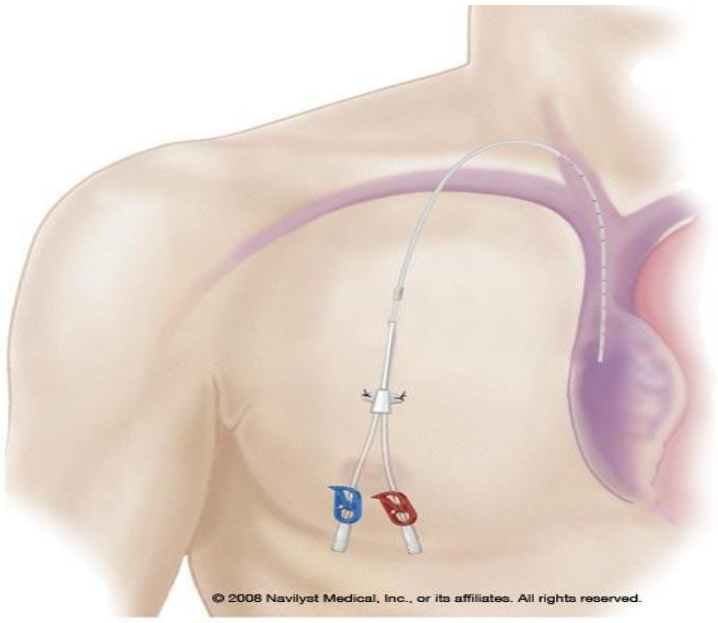


Figure 2.2 Placement of a central venous catheter for haemodialysis
(Sourced:www.navilystmedical.com/index.cmf/112)

Central venous catheters are further categorised into four main types: non-tunnelled devices, tunnelled devices, implantable pores and peripherally inserted central catheters (CDC, 2011). It is believed this helps to ensure standardization of terminologies amongst clinicians and healthcare institutions when considering catheter-related bloodstream infections (O'Grady, Alexander, Burns, Dellinger, Garland, Heard, et al. 2011).

Scales (2010) mentioned that the most frequently used indwelling medical devices are vascular catheters, which have become necessary tools for the successful treatment of patients with chronic and acute illness. Central vascular access in acute care is indicated for:

- Haemodynamic monitoring
- Administration of vasoactive or inotropic drugs
- Haemofiltration, haemodialysis, therapeutic plasma exchange, apheresis and immonoadsorption

- Transvenous pacing
- Administration of irritant drugs and solutions
- Reliable access for fluid and electrolyte administration
- Reliable access for blood sampling
- Diagnostic interventions, e.g. liver biopsy

There are three main vascular access devices as outlined by Scales, 2010: Peripheral cannula, Midline catheter and Central venous access device.

Cotogni and Pittiruti (2014) echoed the same sentiments as Scales in that there are three vascular devices used for critically ill patients which are peripherally inserted devices, midline catheters and centrally inserted devices.

Peripheral cannulae/ catheters are non-tunnelled (made of silicone or ii- iii generation polyurethane) and usually inserted into the hand or forearm for short-term use, they are short devices up to 7.5 cm in length, midline catheters are also peripheral devices but are longer in length than standard peripheral cannulae, being between 7.5cm and 20 cm in length. They are inserted in the region of the anticubital fossa where the tip should be in the cephalic, basilica and brachial vein below level of axilla. Midline catheters are made from silicone or polyurethane, may be single or double lumen and are designed for intermediate use with a dwell time of 1 to 4 week (Cotogni & Pittiruti, 2014; Scales, 2010). Central venous catheters are devices (made from polyurethane) inserted into the central circulation; they are inserted directly or indirectly into the superior vena cava or right atrium. There are four main types of central venous access devices: Non-tunnelled devices tunnelled devices, implantable pores and peripherally inserted central catheters, they are inserted in intensive care and non-intensive care patients and they have one or multiple lumens (Cotogni & Pittiruti, 2014; Scales, 2010).

Intravenous therapy can be administered peripherally or centrally, the difference between the two routes is the size of blood vessels and the blood flow within the vessels. Central blood vessels are large and blood flows fast, whilst peripheral blood vessels are small and often fragile with a slow blood flow. Key factors in the decision to select central venous access for specific infusion therapy is the physical properties of vessel size and blood flow.

Patients who are acutely ill cannot rely on peripheral access for a long time. An ideal device in the emergency setting for rapid fluid resuscitation is a short, wide-bore peripheral catheter and is appropriate for short-term, non-irritant fluid and drug administration (Cotogni & Pittiruti, 2014; Scales, 2010).

According to Scales (2010) and Cotogni and Pittiruti (2014) the most commonly used central venous access device in acute and critical care is the non-tunnelled central catheter. There are three main sites for insertion of the non-tunnelled central catheter: internal jugular vein, subclavian vein and femoral vein.

Scales (2010) continues to highlight that the referred sites for insertion are subclavian or jugular veins as they are associated with a lower infection rate than the femoral site. Non-tunnelled catheters are available in a range of sizes and lengths with 1 to 5 lumens. Unless multiple lumens are essential, a single lumen device should always be selected as multiple lumens catheters are associated with an increased risk of infection.

Non-tunnelled catheters safe dwell time is not known, but frequent monitoring of insertion site is recommended. An antimicrobial impregnated catheter is recommended for patients considered to be high risk for catheter related blood stream infection (Scales, 2010).

Arteriovenous Fistula- Creation of arteriovenous fistula involves anastomosing an artery to a vein through a surgical procedure; it should be created on the non-dominant hand either on radial-cephalic, brachial-cephalic or brachial-basilic (Murphy, 2011). This will push arterial blood into the vein creating distension, vein thickening and engorgement leading to vein maturation that is able to produce adequate blood flow for an effective cannulation and sufficient blood flow for the haemodialysis machine (Murphy, 2011).

According to Wasse, Hopson and Clellan (2010) arteriovenous fistula is the desired access for haemodialysis due to its greater health benefits, adequate blood flow, lesser risk of infection and thrombosis and reduced danger of mortality and morbidity compared to both arteriovenous graft and vascular catheter.

Arteriovenous Graft- Involves implanting a tube subcutaneously between an artery and a vein produced from a synthetic or biological material. Graft is used when fistula has failed; it is placed straight, looped or curve (Murphy, 2011).

Central venous catheter- It involves inserting a catheter on the subclavian, internal jugular and femoral vein. The preferred position of insertion is the right internal jugular vein followed by the left internal jugular vein under strict aseptic technique. Use of central venous catheter is discouraged even though they are beneficial on patients who has no other alternatives but they are advantageous in that they can be used immediately (Murphy, 2011).

All three of these vascular access methods require special nursing techniques and skills to ensure patient safety. Kidney patients are high risk patients because they are not only compromised by electrolyte and metabolic disturbances, but also by immune-deficiencies and other comorbid conditions such as in the case of human immune virus (HIV) (Bedendo et al., 2011).

2.6 EVIDENCE BASED GUIDELINES TO PREVENT HAEMODIALYSIS CATHETER RELATED INFECTIONS

DiCenso, Guyatt and Ciliska (2005:4) described evidence-based practice as *"the conscientious and judicious use of current best evidence in conjunction with the clinical expertise and patient values to guide health care decisions."* Research, past experiences, knowledge, experience of colleagues and family/patients all form this evidence. Oh (2008) defines evidence based practice as careful use of best available research in conjunction with clinical knowledge and judgement to get to best decision to positive patient outcome. Health care teams should make decisions based upon best practice in order to provide the best quality. Evidence-based practice is a way of providing the high quality care strived for and it adds evidence to clinical care decision (George & Tuite, 2008).

Evidence-based practice is a critical component of health care practice today and is also a reality. Use of evidence based practice to promote patient safety is needed by a nurse and they should be aware that evidence based practice can be effectively utilised to find and

analyse data. Care can be provided in an effective, efficient and cost-beneficial way through use of evidence based practice (DiCenso et al. 2005)

According to Phillips (2015), globally as the use of evidence based practise continuous to change, more emphasis is placed on delivery of patient oriented scientific nursing care. Evidence based practice as a vital part of nursing care is used as an outline to make sure that best existing scientific evidence, clinical knowledge and patient influence health care decision.

Guidelines for the prevention of intravascular catheter related blood stream infections were designed to reduce infectious complications associated with catheter use. Nursing guidelines for reducing catheter related infections were published by the Centre for Disease Control (CDC) in 2001 and updated in April 2011 (Headly, 2011).

These guidelines are the combined effort of academic institutions and government agencies to try to save lives and cut costs. Already these nursing guidelines have proved to be effective in the reduction of catheter related infections in hospital based Intensive Care Units by 58% from 2001 to 2009 (Headly, 2011).

The Centre for Disease Control and Prevention (CDC, 2011) reported that 15 million central catheter days (i.e. total number of days of exposure to central venous catheters amongst all patients in the selected population during the selected time period) occur in Intensive Care Units each year. It has also been found that costs of hospitalization and time of stay are independently increased by infections but is not the only one that increases number of deaths. To reduce healthcare costs and improve patient outcome, healthcare providers, insurers, regulators and patient advocates have considerable interest in lowering occurrences these infections. Effort to reduce infection has to be done by all professionals involved in the inserting, caring for and maintaining intravascular catheters (CDC, 2011).

Indispensable means of administering lifesaving therapies to patients in all discipline of nursing is intravascular catheters; however they also provide a route by which pathogens can gain access into the blood stream. Several million intravascular catheters are used annually in the United States (US) alone and in Europe as well. Unfortunately large numbers of patients are put at risk for catheter related bloodstream infection. Patients who

have indwelling catheters are at risk of acquiring catheter related blood stream Infections, but those admitted into the Intensive Care Unit are more prone than those admitted to a general ward. Consequently patients entering hospital via Emergency Departments are at particular risk simply because of frequent and less careful manipulation of catheters as a result of the urgent setting (Vandijck, et al., 2009).

Catheter related blood stream Infections is one of the common nosocomial infections and is associated with significant morbidity, mortality, prolonged length of stay and health care expenditure. Efforts to decrease rate of catheter related blood stream infections, improve patients' safety and quality of care are important because this is the most preventable type of hospital acquired infection. Evidence based recommendations for prevention catheter related blood stream infections has been published by the Centre for Disease Control and Prevention, the Society of Health care Epidemiologists of America and several other societies. Most of the evidence based recommendations are supported by well conducted clinical trials, systematic reviews and meta-analysis where level of evidence is categorised to each individual recommendation, from "category IA" (i.e. strongly recommended) over "category II" (i.e. suggested for implementation up to "no recommendation" (i.e. unresolved issue) (Vandijck, et al., 2009).

2.6.1 Education, Training and Staffing

It is recommended that health care personnel be educated regarding indications for use of catheters, correct maintenance and suitable control of infection measures aimed at preventing intravascular catheter related infections. Adherence to guidelines should be assessed periodically for all professionals working with insertion and maintenance of intravascular catheters (CDC, 2011).

Only professionals who are trained and those who are competence for insertion and maintenance of intravascular catheters should be assigned. Appropriate level of nursing staff should be ensured, as it has been observed that proportion of pool staff or an elevated patient to nurse ratio is associated with catheter related blood stream infection in ICU's where nurses are managing patients with central venous catheter's (CDC, 2011).

Promotion of preventative strategies and staff education in clinical practice may reduce risks of catheter colonisation and catheter related blood stream infection in the ICU setting (Ramritu, Halton, Cook, Whitby & Graves, 2008).

In one pre-post intervention study, facts sheets and posters were sent to the ICU and nurses and physicians completed a 10-page self-study module. Reportedly 4.9 cases per 1000 catheter- days to 2.1 cases per 1000 catheter days of reduction in catheter related blood stream infection were found in the pre and post intervention periods (Ramritu, et al., 2008).

Programmes that are well organised and enable health care providers to be educated and to monitor, provide and evaluate care are critical to the success of the effort. For the past four decades, reports have consistently demonstrated the decline for risk of infection following standardisation of aseptic care and that maintenance and insertion of intravascular catheters by inexperienced staff might increase risk of catheter colonisation (CDC, 2011).

Unequivocal effectiveness in reducing the incidence of catheter related blood stream infection associated complications and cost was shown by specialised "IV teams." It has also been shown that infection risk increases with nursing staff reduction below a critical level (CDC, 2011).

2.6.2 Site of Insertion

The site where intravascular catheter is to be inserted is very important considering the impact on the development of catheter related blood stream infection. A subclavian approach has been reported with lower rates of catheter colonisation compared to the internal jugular approach, but both are reported to be superior to a femoral insertion site (CDC, 2011).

Though the reason for this is unclear, it is associated with the fact that bacteria prefers to reside in skin folds. Not only the site of insertion is to be considered, but factors such as central venous catheter already in situ, presence of local infection or haematoma and risk of mechanical complications also need to be considered. A subclavian approach is preferred by some clinicians for long-time catheterisation for its ease of fixation and comfort, but it does have high rates of insertion complications (CDC, 2011).

A greater risk for catheter-related sepsis maybe posed by the internal jugular site for its proximity to oropharyngeal secretions, but it is utilised preferentially with mechanically ventilated critically ill patients due to less common mechanical complications. The site is easy and safe for insertion, but more likely to cause femoral infection (CDC, 2011).

A risk for infection and phlebitis is directly related to the site at which a catheter is placed. One high risk factor for catheter related blood stream infection is the density of skin flora at the site where the catheter is inserted. No trials have been done to compare number of infections of catheters inserted on jugular, subclavian and femoral veins (CDC, 2011).

Retrospective observational studies showed an association with high risk of colonization of catheters inserted into an internal jugular vein than the ones inserted into a subclavian. A single retrospective study conducted in neonates noted similar findings. High colonisation rates have been demonstrated on femoral catheters compared with subclavian and internal jugular sites when used in adults and in some studies, higher rates of catheter related blood stream infection (CDC, 2011).

Femoral catheters have been found to be related with a higher risk for deep venous thrombosis as compared with internal jugular or subclavian catheters and as such should be avoided if possible. It was also found out in another study that the risk of infection associated with catheters placed in the femoral vein is emphasized in patients who are obese. In contrast to adults, femoral catheters demonstrated a little occurrence of mechanical complications in paediatric patients and might have an equivalent infection rate to that of non-femoral catheters. A subclavian site is preferred in adults for infection control purposes, but other factors should be considered when deciding where to put the catheter (CDC, 2011).

2.6.3 Patient Factors

Patients with kidney failure are more susceptible to infection than others. In patients who are less than 1 year old or greater than 60 years, factors that influence the rate of catheter related sepsis are burns, presence of remote infection, immunodeficiency, intensity of the illness and host defence mechanism impairment, which occurs in shock and traumatic injury (Theaker, 2004).

Patients who have particularly high-risk of catheter related sepsis with *Staphylococcus aureus* are the ones with acquired immunodeficiency syndrome. The presence of sepsis or remote infection is the most notable patient-related factors as they may act as a source of contaminating organisms (Theaker, 2004).

2.6.4 Skin Preparation

Several skin cleansing agents are available in the effort to prevent and lower level of micro-organisms at the insertion point of the catheter. Rate of catheter related sepsis is shown to be reduced by use of topical antimicrobial ointments containing multiple antibiotics (polymyxin-neomycin-bacitracin). However higher incidences of colonisation and sepsis with candida were reported as a side effect. Studies, including randomised and controlled trial, showed that mupirocin, which is an anti-staphylococcal agent, significantly reduced central venous catheter colonisation, however, others found that growth of resistant organisms and super infections are associated with the use of antibiotic ointment and, for that reason, cannot be recommended. Results of randomised trials in recent prospective studies suggest that 2% Chlorhexidine is superior to Povidine Iodine for cutaneous disinfection of the insertion site (CDC, 2011).

Lesser amounts of catheter colonisation or catheter infection related with the use of chlorhexidine preparation has been shown by studies that are well-designed for evaluating the use of chlorhexidine-containing cutaneous antiseptic regimen in comparison with either Povidine Iodine or alcohol for the care of an intravascular catheter insertion site (CDC, 2011).

Risk of catheter related infection is reduced by 49% by use of chlorhexidine preparations to Povidine Iodine as suggested by a meta-analysis of 4,143 catheters. Chlorhexidine use, rather than Povidine Iodine, for central venous catheter care would result in a 1.6% decrease in the incidence of catheter related blood stream infection, a 0.23% decrease in the incidence of death and a saving of $113 per catheter used, as suggested by economic decision analysis based on available evidence (CDC, 2011).

A 5% Povidine Iodine solution of 70% ethanol was related with a large drop of central venous catheter-related colonisation and infection linked with 10% aqueous Povidine

Iodine, even though chlorhexidine has come to be an accepted disinfection for skin preparation for the insertion of central and peripheral venous catheters (CDC, 2011).

2.6.5 Dressing

According to CDC (2011) transparent, semi-permeable polyurethane dressings require does not require frequent changes like standard gauze dressing and it allows for optical inspection of the catheter site. Study done showed no substantial clinical difference exists in the incidence of colonization between transparent and gauze dressing and the use of dressing is seen as a matter of choice.

2.6.6 Antibiotic/Antiseptic Ointment

According to CDC (2011) different topical antibiotics have been used in trying to reduce infection of catheter insertion site and the use of Povidone Iodine or bacitracin/gramicidin ointment at the catheter exit site is recommended as long as it does not interact with the material of the catheter. Use of topical Mupirocin at the catheter insertion site demonstrated reduction in the risk of catheter related blood stream infection.

2.6.7 Anticoagulation

Catheter is quickly coated with conditioning film, plasma proteins, fibrin, cellular elements such as platelets and red blood cell after it is inserted. Anticoagulants have been used to reduce thrombosis and risk of infection as there is a close relationship between catheter and infection. Catheters are provided with antimicrobial activity which provides it with anti-thrombotic effect because they are heparin bonded but heparin-induced thrombocytopenia can hence clinicians have opted to using Trisodium citrate (CDC, 2011).

2.6.8 Full Barrier Precautions

Full sterile barrier precautions such as the use of a mask, cap, sterile gloves, gown and sheet drapes are needed for insertion of a central venous catheter to minimise the risk of iatrogenic induced catheter related blood stream infection. Nurses can make a substantial contribution in reducing incidence of catheter related blood stream infection by keeping an

eye on the catheter insertion procedure even though they are not authorised to place central venous catheters (CDC, 2011).

Use of maximal sterile barrier precautions during placement of central venous catheter should be standard care, but costs and workload associated with its use during insertion of peripheral and artery catheters should be considered, however in immune compromised patients, such as the ones requiring renal replacement therapy, it might be advisable to use all precautions regardless of extra costs (CDC, 2011).

2.6.9 Hand Hygiene

Improper hand washing techniques, which result in the cross contamination of patients have been identified as the biggest nurse-related factor for CRBSI. Hand decontamination before and after patient contract is one of the most important measures to reduce the spread of germs. Hand hygiene includes one of the following washing hands with soap and water if there is visible dirt or soiling with body fluids or using an alcohol based antiseptic in the absence of soiling.

Cornerstone of infection prevention and control is effective hand hygiene with either conventional antiseptic soap, water or alcoholic hand rubs. Hand hygiene must be performed before and after every palpation, repairing, manipulation and dressing of intravascular catheter (CDC, 2011).

2.7 NURSES KNOWLEDGE RELATED TO EVIDENCE-BASED GUIDELINES FOR CATHETER RELATED BLOODSTREAM INFECTIONS

A number of studies were found during the literature search that demonstrated nurses' poor knowledge related to prevention of catheter-related bloodstream infections.

In the first study, Labeau *et al.* (2009) aimed to determine nurses' knowledge of guidelines in preventing central venous catheter-related infections from the CDC guidelines. This large multi-national study was conducted in 22 European countries, using a validated multiple-choice questionnaire of 10 recommendations for central venous catheter-related

infection prevention. A total of 3 405 questionnaires were collected, yielding a response rate of 70.9%, and the mean test score was 44.4% (Labeau et al. 2009).

Results from this study revealed, slightly more than half of the sample knew that central venous catheters should be replaced on indication only; and 74% knew this also concerns replacement over a guide-wire; less than half (43%) of the sample knew that central line dressings need to be changed on indication and at least once weekly; 25% of the sample knew that both polyurethane dressings and gauze dressings are recommended.; only 15% of the sample checked the recommended 2% aqueous solution as the recommended disinfection solution; a close one third (30%) of the sample knew antibiotic ointment solutions are not recommended because they trigger resistance; most (90%) nurses knew to replace administration sets after lipid infusions, but only 26% knew sets need to be replaced every 96 hours (Labeau et al. 2009). The study also reported, professional seniority and number of ICU beds was an independent factor associated with a better test score (Labeau et al. 2009).

A recent study by Chen, Yao, Chen, Liu, Miu, Jiang, Zhu, Tang and Chen (2015) aimed to evaluate nurses' knowledge of the updated guidelines CDC (2011) guidelines. This national study was conducted on a sample of 455 Chinese nurses, using a validated questionnaire developed by the researchers. The mean score was 8.17 of 20, and higher scores were significantly associated with years of ICU experience.

Results of this study indicated, 49 (10.7%) nurses had not heard about the CDC guidelines, whereas 231 (50.7%) nurses heard of the guidelines but had not received training for them. Trained nurses' scores were higher than untrained nurses' scores. The three major barriers to compliance with the guidelines were unfamiliarity with them, an excessive workload due to nurse shortages and a lack of training (Chen, et al. 2015).

A further search of the literature was undertaken, which yielded 2 important studies conducted in the renal dialysis units that demonstrated similar results to the afore-mentioned studies (Chen, et al. 2015; Labeau, et al. 2009).

For example, in a study conducted by Abdelsatir (2013), that aimed to evaluate nurses' awareness and practice of haemodialysis vascular access care. This national study was

conducted on a sample of 50 nurses in Khartoum, Sudan, whereby nurses' knowledge was evaluated using a self-administered questionnaire and their practices were evaluated by direct observation.

Results of this study (Abdelsatir, 2013) revealed, females constituted 72% of the sample, most (83%) were university graduates and more than half (58%) had more than 2 years of clinical experience. Most of the respondents received dialysis training (56%) and vascular access management (54%): all respondents thought proper haemodialysis access care prevent infection, but only 54% stated that it maintained access function. Most nurses (98%) indicated that hand hygiene was necessary to prevent infection, but only a close three-quarters of nurses (70%) followed hand washing procedures before haemodialysis access manipulation; most nurses evaluated it before connection but only 52% evaluated it for signs of infection (Abdelsatir, 2013). In addition, the study also reported that nurses with a higher level of education (graduates) were more compliant to hand washing procedures (72.5% vs. 42.9%; p=0.1), and the use of gloves (100% vs. 85.7%; p=0.1) compared to diploma level prepared nurses, however, these differences were found not to be statistically significant (Abelsatir, 2013).

In the next study, Higgens and Evans (2008) investigated nurses' knowledge and practice of vascular access infection control among adult patients in Ireland. A questionnaire was used in the study to assess knowledge and behaviours in infection control of 190 nurses in 9 haemodialysis units. Results of this study, revealed that although most of the respondents (92%) reported that policies had been developed in their units but less than half of respondents (47%) received infection control training, knowledge and adherence to best practice demonstrated scope for improvement (Higgens & Evans, 2008). They recommended development of standard guidelines, regular reviews and updates of policies to ensure a high level of compliance (Higgens & Evans, 2008).

2.8 BARRIERS AND FACILITATORS TO EVIDENCE BASED PRACTICE GUIDELINES

A study conducted by Oh (2008) aimed to identify the utilization of evidence for practice and to examine factors related to research barriers among Korean critical care nurses. Data

was analysed from 63 critical care nurses from a national study at university affiliated and educational hospitals in Korea.

Perception of barriers to research utilization total mean scores from the study was 2.37 (SD=0.42), administrative factors was the highest mean barrier score for each factor and five top perceived barrier items were: *"Implementation for practice is not clear"; "There is insufficient time on the job to implement new ideas"; "There is not a documented need to change practice"; "The facilities are inadequate for implementation"; The nurses does not have time to read research"* (Oh, 2008).

The study findings indicated that nurses share a solid sense of value for input that research makes to advance their practice but also perceived barriers in the absence of administrative support for evidence based practice. Absence of practical implications of research was the most problematic barrier (Oh, 2008).

Another study was done by Phillips (2015) to establish relationship between duration of practice, educational level, and perception of barriers to implement evidence based practice among critical care nurses, 30 critical care nurses took part and the response rate was 60% (30/50). Majority of the participants were women 83% (n= 25) between the ages of 30 to 39 years and holding a Bachelor's or higher degree.

Participants were asked question to determine knowledge, attitudes and use of evidence based practice, a scale of 1 to 7 was used to rate current evidence based practice attitude, knowledge and practice where 7 was an ideal score. Attitude towards evidence based practice showed highest mean score (mean = 4.89), then by knowledge (mean = 4.37) and uses of evidence-based practice (mean = 4.30) (Phillips, 2015).

In addition, the Pearson correlation was computed on results and strong relationship was established among scale measuring barriers to implementation of evidence based practice, strongest correlation was between 'knowledge of evidence based practice' and 'attitudes towards evidence-based practice ($r= 0.848$; $p <0.001$) indicating that participants with high knowledge scores had positive attitudes towards use of evidence based practice (Phillips, 2015).

Phillips (2015) highlighted that an important relationship was established between characteristics of organization and of the nurses (r=0.830, p< 0.001) this means the more organizational boundaries that exist for nurses the more likely they are to devalue the importance of evidence based practice.

As Phillips (2015) indicates again, nurses were asked to rate their perceived barrier to evidence based practice implementation, *"the mean barrier scores was 2.58, which is highest in communication factor (mean = 2.58), then the setting at (mean = 2.48), nurse adopter (mean = 2.11) and quality research at (mean = 1.84)".* The highest three perceived barriers items to use of evidence-based practice were: *'unwillingness to change or try new approaches (76.7%)*'; there is insufficient time to read research relevant to practice and the evidence is no kept in a central location (73.3%)'; lack of authority to initiate changes relevant to patient care (66.7%).

2.9 SUMMARY

Literature has indicated that the number of people developing kidney failure and requiring renal replacement therapy is increasing. The majority of these people use vascular access catheters which carry a significant risk of catheter related blood stream infection and leads to high medical cost, length of stay, mortality and morbidity.

Research has shown that vascular access infections are the second leading cause of morbidity and mortality in patients receiving haemodialysis, which is said to be caused by new or inexperienced dialysis staff, nurses not well trained in accessing the patient's circulation and not following the correct arteriovenous access techniques, applying the infection control procedures or adhering to the standards in sterile catheter care. It is recommended that to prevent these life-threatening malpractices, training and competency assessment of staff needs to be regularly assessed and recorded with on-going professional skills development.

In the prevention of catheter related blood stream infection, the Centre for Disease Control came up with strategies/guidelines for the prevention of intravascular catheter related blood stream infection. The guidelines were designed with the aim of reducing complications related to catheter use. Nursing guidelines for reducing catheter related

infections were published by the Centre for Disease Control (CDC) in 2001 and updated in April 2011 (CDC, 2011). These guidelines are the combined effort of academic institutions and government agencies to try to save life's and reduce hospitalisation costs. Already these guidelines have proved effective in the reduction of catheter related infections in hospital based Intensive Care Units by 58% from 2001 to 2009 (Headly, 2011).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

In this chapter research methodology will be presented and will include the research design, the research setting, population, sample and sampling, the criteria which includes, collection of data, a description of the data collection instrument used including the reliability and validity of the instrument and the ethical procedures followed. The purpose of the study was to determine nephrology nurses knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related bloodstream infections in the renal dialysis units from two university-affiliated, public sector and tertiary level hospitals in Gauteng.

3.2 OBJECTIVES OF THE STUDY

For consistency in the study, the objectives are repeated.

- To validate the instrument *"Evaluation questionnaire concerning nurses' knowledge of interventions for prevention of haemodialysis catheter associated infections"* to assess nurses' knowledge on evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections.
- To determine and describe nurses' knowledge of evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections in the haemodialysis units from public sector institutions in Gauteng.
- To establish whether there is a relationship between age, experience and knowledge of nurses on evidence-based guidelines of haemodialysis catheter-related bloodstream infections

3.3 RESEARCH DESIGN

A research design is the logical steps taken to answer the research question by the researcher and forms the blue print of the study and determines the methodology used to

gather information (Brink, van der Walt & van Rensburg, 2010). A non-experimental, descriptive, prospective and contextual research design was used to meet the objectives of the study.

3.3.1 Non Experimental

In a non-experimental design the units that have been chosen to take part in the research are measured on all the relevant variables at their natural setting and there is no manipulation of variables that take place and no experiments involved (De Vos *et al*, 2013).

The purpose of non-experimental research is to define occurrences' in order to describe relationships between variables. A non-experimental design was selected for the study because the independent variables cannot be manipulated, there are no experiments required and variables will be studied in their natural setting (renal dialysis unit).

3.3.2 Descriptive

A descriptive design is used to obtain more information about characteristics within a particular field of study with the purpose of providing a picture of situations as they occur in their natural setting (Burns & Grove, 2009). The descriptive design was used in this study to identify problems and gain knowledge on current nursing practices.

3.3.3 Prospective

Prospective design is used when causes have occurred but the proposed effect has not; the researcher starts with an effect and determines the cause. Prospective studies are more powerful when inferring causality: for example it can demonstrate that risk factors occurred before illness and are related to the illness positively (Burns & Grove, 2009).

3.3.4 Contextual Design

According to Burns and Grove (2009), the setting is the location where the research study is conducted, and it can be described as natural, partially controlled or highly controlled.

The research setting for this study was five haemodialysis units in two (n=2) university affiliated, public sector and tertiary level hospitals in Gauteng. Data was collected strictly from nephrology nurses working in the five (n=5) renal dialysis units.

3.4 RESEARCH METHOD

The instrument of the study was based on evaluation of nurse's knowledge of haemodialysis catheter-related bloodstream infections prevention evidence-based guidelines taken from Centre for Diseases Control and Preventions (CDC) (CDC, 2011). The instrument was validated for suitability for the South African context by a panel of six (n=6) experts.

The data collection instrument was used to gather demographic data from participants, followed by collection of data using the data collection instrument which was validated by the expert group. Prior to commencement of the study the instrument was subjected to a pre-testing process.

A non-probability purposive sampling method was used to select experts for content validity of the data collection instrument. Highly educated nephrology nurses were approached to participate in the validation of the instrument.

3.4.1 Population

A population is the entire element that meets the sampling criteria for inclusion in the study and who the researcher is interested in, a targeted population is the entire element who meets the sampling criteria, whereas accessible population is the portion of targeted population that the researcher has access to for purpose of the study (Brink et al., 2010).

The population of the study in objective I (instrument validation by experts) contains nephrology nurses (experienced and trained) and currently working in haemodialysis units and also nephrology specialist nurse educators (n=6). The population was chosen because they are nephrology nurses who possess knowledge in the nephrology field and nursing education and are involved in research and evidence-based practice. Population of

objective two of the study included registered nurses who are experienced and working at five haemodialysis units in two public sector hospitals in the Johannesburg region.

3.5 SAMPLE AND SAMPLING

Objective I

According to Brink *et al.* (2010), sample is defined as a part of a whole or a subset of a larger population, which is selected by the researcher to be part of the study. Sampling is the process of choosing a sample from a population in order to obtain answers regarding phenomena under study in a manner that represents the interest of the population (Brink et al. 2010).

Experts were selected using a non-probability purposive sampling in order to validate instrument for data collection as to ensure it is applicable in the South African context. Six nephrology specialist nurses, as well as specialist nurses in education, were requested to take part in a pilot testing group to help with the validation process of the instrument. Experts Nurses who meets the criteria for inclusion were sent an information letter (**Appendix A**) and requested to take part in the study. A consent form (**Appendix B**) and the tool for data collection (**Appendix C**) were also sent to the participants.

Inclusion criteria for the expert group were:

- Nephrology nurses employed in both acute and chronic haemodialysis units, who were willing to participate in the study and provided signed consent to participate in the study.
- Nurses with expert knowledge in nephrology or nursing education and willing to participate in the study and had signed consent to participate in the study.

Objective II

The sample consists of nephrology nurses in the five haemodialysis units. Biostatisticians from the University of the Witwatersrand were approached to decide on the appropriate number of subjects that will offer a sample that is representative of the population under study. Following discussion with a statistician, the sample size decided upon was 80 nephrology nurses (n=80), from the five (n=5) haemodialysis units of two public sector

hospitals (n=2). A non-probability purposive sampling method was used to select the study participants.

Inclusion criteria for the prospective nurse participants were:

- Nephrology nurses and agency nurses (trained and untrained), working in all five haemodialysis units in public healthcare institutions. Nephrology nurses from two (n=2) public health care institutions were chosen based on the similarity in practices between both institutions.

Exclusion criteria include:

- Lower categories of nurses (Enrolled and auxiliary) were excluded as they are not expected to be skilled and have advanced knowledge of haemodialysis catheter-related sepsis and best practice guidelines on prevention of haemodialysis catheter-related infections.

Information letter (**Appendix F**) was given to nurses who met the criteria for inclusion and were asked to take part in the study. A consent form (**Appendix E**) and the data collection tool (**Appendix D**) were also given to the participants.

3.6 DATA COLLECTION

3.6.1 Instrument

The instrument used in the study was developed from the Centre for Disease Control and Prevention (CDC) "Guidelines for the Prevention of Intravascular Catheter-Related Infections" (CDC, 2011). Permission to use the guidelines to formulate a research instrument was not requested as it was developed from an open source.

The instrument is a validated and reliable questionnaire, designed to assess nurse's knowledge of haemodialysis catheter-related infection prevention evidence-based guidelines (CDC. 2011). Eleven (11) strategies, which are relevant to practice of nursing and proven in literature, to prevent haemodialysis catheter-related infections were recorded and where respondents had four response to choose from: there was one right response and three other incorrect alternatives, which included the choice "I don't know" to prevent

participant's taking a chance and with other two choices having been proven to have a preventive value in haemodialysis catheter-related infections.

The instrument included demographic data of the participants such as gender, years of experience working in haemodialysis and whether they had a degree or diploma in nephrology nursing. The second part of the questionnaire asked participants for their opinion on whether they thought they had sufficient information on the prevention of haemodialysis catheter-related infections.

3.6.2 Validity and reliability of Instrument

Experts were selected to ensure that the instrument for data collection is valid and applicable for South Africa. Six nurses specializing in nephrology and nursing education were asked to take part in a pre-testing group for a validation process of the data collection instrument.

3.6.3 Procedure

Permission to conduct the study was sought from the Universities Ethics Committee and the Chief Executive Officer (CEO) of the hospitals participating in the study and where data collection will take place.

Information letters (**Appendix A**) were sent to expert nurses who met the inclusion criteria and requested to participate in the study. A consent form (**Appendix B**) and the tool for collection of data (**Appendix C**) were sent to the participants. A focus group was held, to discuss the validity of the instrument and suitability for South Africa, based on Lynn's Model of Level of Agreement (Lynn, 1986).

A letter of request was send to management of the institutions were the study was going to be conducted requesting permission to conduct the study (**Appendix I**). Once permission was granted, the nursing managers were approached for permission to conduct the study in their units. Nephrology nurses in the selected haemodialysis units were to be informed about the research purpose and objectives. Confidentiality of data and anonymity was ensured and it was explained that participation in the study was voluntary. Potential

participants were invited to ask questions they may have in relation to the study and were informed that they can refuse to take part in the study or refuse to respond to any particular question and can withdraw from participation at any given time without penalty. An information letter was distributed to prospective participants and they were requested to sign a consent form (**Appendix E** and **Appendix F**). The data collection tool was given to nurse participants who gave permission to participate in the study by the researcher (**Appendix D**). Completed questionnaires were placed in a sealed envelope and collected by the researcher from each unit on a week basis.

3.6.4 Data Analysis

Descriptive and inferential statistics were used to analyse demographic data and to evaluate nephrology nurses knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related infections.

According to Burns and Grove (2009), descriptive statistics allows the researcher to organise data in a manner that gives meaning and facilitates insight and inferential statistics allows for making conclusions from a sample to a population. The following statistical tests were used:

- Frequency distribution, measures of central tendency, measures of variability and degree of freedom were used to describe participants' data.
- Content validity was used to calculate the percentage of experts that judged the content of the instrument items as valid (with a score of 3 and 4).
- A Pearson correlation coefficient (r) was employed to assess the amount and direction of the relationship between ages, years of experience in the unit, qualification and knowledge of evidence-based guidelines for the prevention of dialysis catheter-related infections.
- Non-parametric statistical tests of Kruskal-Wallis and Chi-Square were used to assign rank to the scores of the group and to compare distribution of responses.
- A one way analysis of variance (ANOVA) was used to determine scores and significance of the data.

A statistician from the postgraduate office was consulted to assist with the analysis of the data. The statistical software package Statistica^{TM} version 12 was used, and testing was done on the 0.05 level of significance ($p<0.05$).

3.7 VALIDITY AND RELIABILITY

3.7.1 Validity

Validity refers to the extent to which the instrument accurately measures what it should measure (De Vos, et al., 2011). In this study validity was ensured by using an instrument that was validated by panel of experts and the researcher did not deviate from procedures stipulated. Advice was sought from a statistician in terms of data capturing, processing, analysis and interpretation. A safe environment was ensured by informing participants that participation was voluntary and anonymity would be ensured.

A process of pre-testing was done to ensure feasibility of the study and detect possible flaws in the instrument used. Content validity index (CVI) was achieved by having the data collection instrument reviewed by expert nephrology specialist nurses. Prospective studies allowed for investigation of unusual or unexpected results during the data collection and possible causes that yield such results.

3.7.2 Reliability

Reliability refers to accuracy and consistency of the measures obtained when using a particular instrument, meaning the same results should be obtained if the test is administered to the same individuals at different times and it indicates the extent of a random error in the measurement method (Burns & Grove, 2009).

Reliability was maintained by ensuring consistency and accurate recording of data. Only the researcher undertook data collection; data was verified by the statistician for accuracy. An appropriate sample size was determined by the statistician to ensure representativeness of the population under study. Sample inclusion and exclusion criteria were followed.

3.8 PRE-TESTING THE INSTRUMENT

Burns and Grove (2009) define pre-testing as a lesser version of the planned study and usually conducted with the objective to refine the methodology. A pre-testing process was carried out prior to the commencement of the main study. Its purpose was to fine tune the instrument for the main study and also to determine whether the methodology and analysis were adequate and appropriate for the main study (De Vos, et al., 2013). The data collection instrument on knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related infections was used on five respondents (n=5) in the renal dialysis unit, at the study selected sites before commencement of the main study.

The results of pre-testing proved that the instrument tested what was measured. The questions were clearly understood and the participants completed it to the best of their ability. No changes with regard the content of the instrument was made. The results of the pre-testing was not be used in the main study.

3.9 ETHICAL CONSIDERATIONS

All research requires the researcher to consider the protection of human rights of the study participants. Burns and Grove (2009) stated that this includes the right to self-determination, privacy, autonomy and confidentiality, fair treatment and protection from comfort and harm. In order to consider the protection of all these rights the following ethical requirements were taken into consideration during and prior to commencement of the study.

- The research proposal was sent to the University Postgraduate Committee for permission to conduct the study.
- Application for clearance to conduct research was sent to the Committee for Research on Human Subjects (Medical) of the University of Witwatersrand and a clearance certificate was issued.
- As objective one is to validate/verify the instrument, if the instrument is altered the new version must be submitted to the secretariat of the Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand. The research instrument was not altered by this study.

- Permission to conduct the study was obtained from the management of the participating hospitals (CEO) on behalf of the Department of Health, Gauteng.
- Confidentiality and anonymity of the participants was ensured in that no names were used during data collection and reporting of information. Consent sheets and questionnaires were separated during data collection and analysis to ensure participants' anonymity.
- All the nurses were informed that participation in the study was voluntary and they could decline to answer any particular questions or discontinue participation at any time without incurring penalty.
- The instrument used for data collection was developed from an open source document where permission is granted to those researchers who wish to use it in research studies.

3.10 SUMMARY

This chapter described the research methodology. The research design was selected to appropriately meet the study's purpose and objectives. An in-depth description is given of the instrument used for data collection. A pre-testing procedure was conducted at the main study site using the data collection schedule, which successfully met the study's objectives.

The following chapter presents data analysis and research findings.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 INTRODUCTION

In this chapter, data analysis is discussed in detail. Data files were set within the computer statistical package Statistica™ version 12; data was entered once and verified during second data entry. Descriptive and inferential tests were used to achieve the study objectives. Descriptive tests (frequency, mean and standard deviation) were used to summarise participant's demographic data and questionnaire schedule. While inferential statistics was used to describe and synthesise questionnaire scores and compare the demographic data of respondents with obtained level of measurements to test for statistical significance. Testing was done at the 0.05 level of significance ($p<0.05$).

This chapter describes the analysis of data using descriptive statistical tests and interpretations of findings.

4.2 APPROACH TO DATA ANALYSIS

Descriptive statistics was used to present interpretation of data of nurse respondents. This included age, gender, years of working experience in the unit and qualifications in nephrology nursing. Frequency distributions and cross tables were used to provide an overall presentation and description of the data. Means and standard deviations were used to summarise the respondent's demographic data. Pearson's correlation coefficient (r) was used to determine the association between respondents age, years of experience working in the unit, qualification and knowledge of the evidence-based guidelines for prevention of haemodialysis catheter-related infection. A one-way analysis of variance was used to determine total scores and differences in the scores on the questionnaire schedule. A 3-dimensional scatterplot was used for display of paired scores between selected variables and tables were used to describe frequencies and percentages. Testing was done at the 0.05 ($p<0.05$) level of significance. A statistician analysed the data using the statistical package Statistica™ version 12.

4.3 VALIDATION OF THE INSTRUMENT

The demographic data of the respondents will be presented followed by determination of content validity of each item and the entire instrument.

4.3.1 Demographic data

This section related to expert group respondent demographic data, which comprises four (4) items. Items included were age in years, gender, qualification and years of experience working in nephrology nursing. Results of this process are summarised in **table 4.1**.

Table 4.1 Demographic data for panel of Nephrology nurse experts (n=6)

Item	Variable	Frequency	Percentage
Q1	Age in years		
	30 – 39	2	33.3%
	40 – 49	1	16.7%
	50 - 59	3	50.0%
Q2	Gender		
	Male	1	16.7%
	Female	5	83.3%
Q3	Academic qualifications		
	Diploma in nephrology nursing only	4	66.7%
	Diploma and Master's degree in nephrology nursing	1	16.7%
	Master's in nephrology nursing	1	16.7%
Q4	Years of experience		
	1 to 4	1	16.7%
	5 to 9	3	50.0%
	10 to 15	1	16.7%
	16 to 20	1	16.7%
	21 to 31	-	

Age group of the respondents in the discussion group were as follows: Two (33.3%) of the six nurse experts respondents were between 30 to 39 years, one (n=1; 16.7%) of them was between 40 to 49 years, whereas three (50%) of them were between 50 to 59 years of age. Academic qualifications of the respondents in the discussion group were as follows: Of the six nurse experts, four (66.7%) had a diploma in nephrology nursing. Two (n=2; 33.3%) had obtained a diploma and an additional master's degree in nephrology nursing. Apart

from the nephrology nursing specialisation, some of the nurse experts had also obtained different additional qualifications. One (n=1; 16.7%) had a certificate in HIV/AIDS care and one (n=1; 16.7%) held a bachelor's degree in nursing administration and education.

The nurse respondent's years of experience ranged between 5 to 25 years, with a mean year of experience being 16.

4.3.2 Content Validity of the Instrument

Content validity of each item and the entire instrument was determined by following the statistical method according to Lynn (1986). According to method four of six respondents had to rate each item as four to ensure the item was content valid. In this study, items two and eleven were rated as content valid by four of the six experts providing an agreement rating of 95%. The remaining items were rated content valid by all the experts. The results are shown in **figure 4.1**.

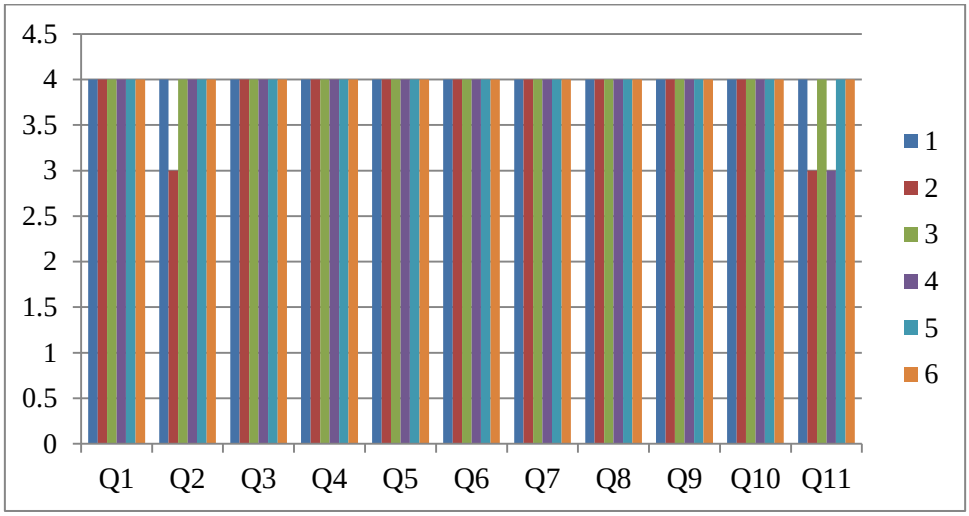


Figure 4.1 Experts panel rating of the questionnaire item content validity

The content validity of the whole instrument was the percentage of items judged as valid by the experts. Polit and Beck (2010) stated that an instrument should have a minimum content validity index of 0.90. In this study, the content validity of the entire instrument was 0.98. The experts rated the whole instrument as being content valid.

4.4 RESULTS AND FINDINGS

4.4.1 Section A: Demographic Data

This section related to respondent demographic data, which comprised four (4) items. Items included age in years, gender, qualification and years of experience working in nephrology nursing. Results of this process are summarised in **Table 4.2** for the total sample (n=80). Items were combined to form coherent groups to facilitate the discussion of the data.

Table 4.2 Distribution of demographic data obtained from nurse respondents (n=80)

Item	Variable	Frequency	Percentage
Q1	Age in years		
	25 to 29	7	8.8%
	30 to 39	26	32.5%
	40 to 49	25	31.3%
	50 to 59	22	27.5%
Q2	Gender		
	Male	15	18.8%
	Female	65	81.3%
Q3	Qualification		
	Not nephrology trained	35	43.8%
	Nephrology trained	45	56.3%
Q4	Experience in years		
	1 to 4	44	55.0%
	5 to 9	16	20.0%
	10 to 15	11	18.8%
	16 to 20	5	6.3%
	21 to 31	4	5.0%

Of the entire sample (n=80), males accounted for 18.75% (n=15) and females 81.25% (n=65). The highest (32.5%; n=26) number of nurses were between the ages of 30 to 39 years and 31.3% (n=25) were in the 40 to 49 age categories. It can be extrapolated from these findings that female nurses predominate the total sample (n=80). However, age categories indicated opposite higher and lower frequencies in the 40 to 59 (58.8%; n=47) and 25 to 39 (41.3%; n=33) age groups, implying in terms of age distributions this is a mature nursing population.

4.4.1.1 Age distribution

In this study, it can be seen that 32.5% (n=26) of nurses were between 30 to 39 years of age, 31.3% (n=25) were between 40 to 49 years, 27.5% (n=22) were in the 50 to 59 age category, whilst only 8.8% (n=7) were in the 25 to 29 year age group. Approximately 58.8% (n=47) of respondents fall within the 40 to 59 age category, whilst 41.3% (n=33) are between 25 and 39 years of age, which indicates an ageing or mature nurse population. New strategies to recruit and retain nurses are needed to be able to meet the needs of the population. **Figure 4.2** displays the results.

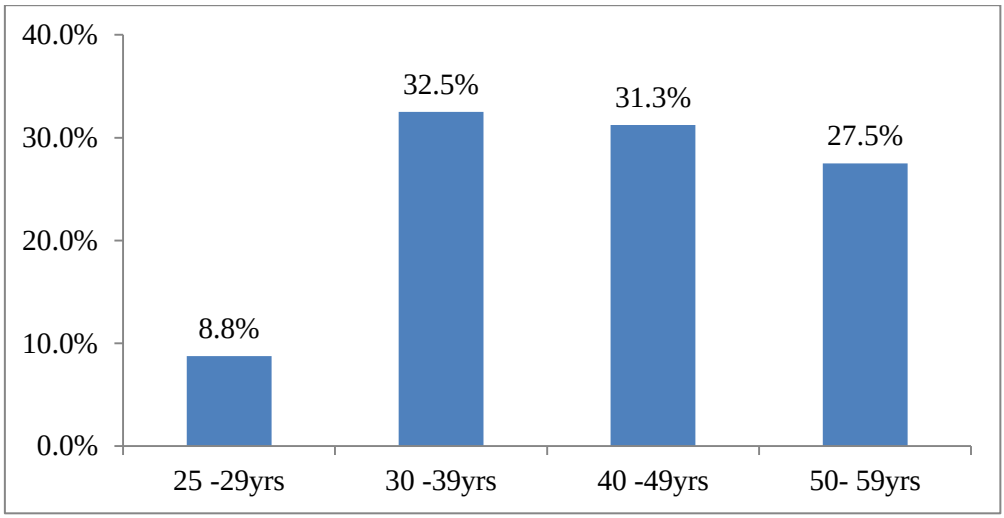


Figure 4.2 Age distribution of nurse respondents (n=80)

High rates of turnover amongst nurses occur globally. In 2008, it was estimated there were 40.3% vacant posts for registered nurses throughout South Africa. Mokoko, Ehlers and Oosthuizen (2011) stated, "during the 1998 United Nations Conference for trade, it was estimated that per annum South Africa lost US$184 000 for every South African, aged 25 to 35, who emigrated from the country". According to these authors, other countries target South African nurses and offer them better rewards, competitive salaries as well as better resources and working conditions (Mokoka, et al., 2011). These aspects place a strain on the remaining South African nurses, who have to carry the burden of an increased workload under difficult circumstances.

South Africa is a country from which other countries recruit registered nurses who wish to emigrate due to personal and professional reasons. A number of nurses in South Africa

belong to the baby boomer generation (born between 1943 and 1964) and who will be retiring in the close future. Internationally, shortage of nurses is complex and predicted to become worse because of an ageing population. On average the age of practicing South African nurses is between 44 to 46 years (Mokoka, et al., 2011).

Clendon and Walker (2012) highlighted that in New Zealand nurses aged over 50 years make up more than 40% of the nursing population, 30% and 62% in the UK and Australia, respectively. In New Zealand the median age of nurses is currently 46.7 years, in 1998 it was 42.6 years and in 2002 44.8 years; figures are similar globally (Clendon & Walker, 2012). Approaches to retain young people is important to ensure sufficient nurses are produced and educated to meet the health needs of the growing population and to replace nurses who will retire in 20 years' time.

4.4.1.2 Gender distribution

In this study, females accounted for 81.3% (n=65), whilst males accounted for 18.8% (n=15) showing a largely female dominated sample. **Figure 4.3** displays the results.

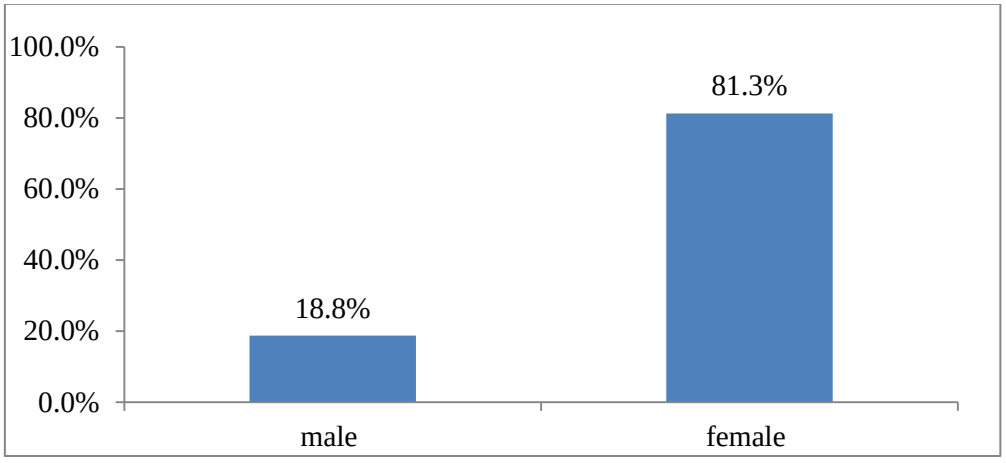


Figure 4.3 Distribution of gender of all respondents

Research illustrates that nursing is a predominantly female dominated profession whilst men remain in the minority. In Canada, only 5.8% of the workforces of registered nurses are males and despite a global shortage of nurses and call for diversity in the profession, the number of males entering the profession remains unchanged (Meadus & Creina, 2011). In the United States male nurses represent approximately 7% of the nursing workforce and

these findings are not unique to the USA; throughout the world males represent the minority in the nursing profession (Colby, 2012).

Meadus and Creina (2011) stated that women have positioned themselves in previously male-dominated professions such as dentistry, pharmacy and medicine: there has been a slow movement of males into nursing. Nursing students suggested that greater efforts are needed to increase the proportion of males in the nursing profession, which could provide the solution to nursing shortages as well as bringing diversity to the nursing population (Meadus and Creina, 2011).

Evidence suggests that nursing education programmes are based largely on the female worldview and this type of discrimination and gender bias prevents recruitment and retention of men into the profession. One major barriers for men seeking to enter nursing, as confirmed by research, is sexual stereotypes; it is assumed that men choosing nursing are gay (Meadus & Creina, 2011).

4.4.1.3 Qualifications

In line with the statistics of the South African Nursing Council (2008), majority (56.3%; n=45) of the nurses had a post basic diploma in nephrology nursing in this study, whilst 43.8% (n=35) were not trained in the speciality. **Figure 4.4** displays the results.

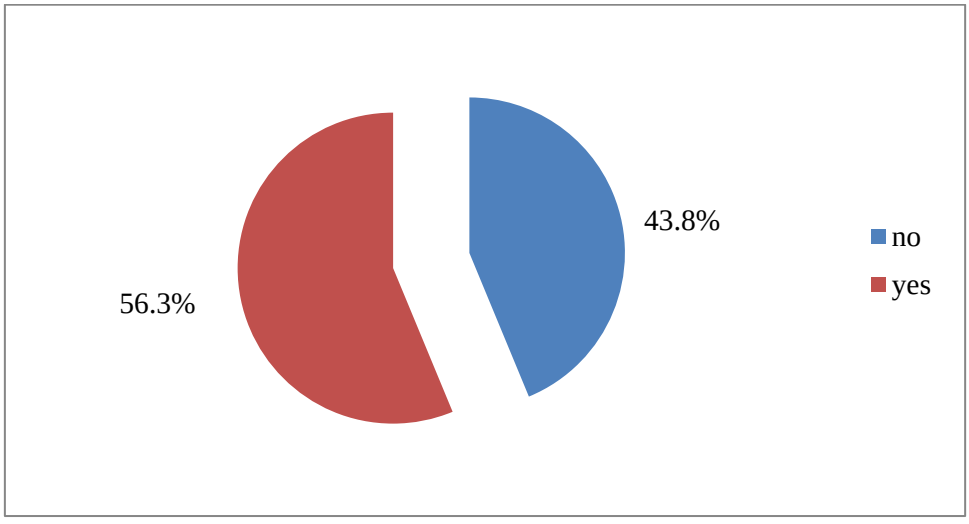


Figure 4.3 Distribution of qualifications in nephrology nursing (n=80)

According to the South African Nursing Council (SANC), nephrology nursing is a specialised nursing practice and distinct area that addresses prevention, promotion and management of the health of renal failure individuals. It occurs at primary, secondary and tertiary care settings for patients who are at risk and experiencing chronic renal failure. Nephrology nurses need evidence based knowledge and excellent clinical competencies beyond those acquired in a basic nursing programme (SANC, 2013).

High quality, cost-effective, family focused care is mandated by the present healthcare environment. The chronic renal disease population will continue to grow, as indicated by the trends in the incident and prevalence of these patients and this growth will be accompanied by the need for highly specialised nurses who are sufficiently knowledgeable and skilled to manage and coordinate these complex patients (SANC, 2013).

4.4.1.4 Years of working experience

Of the total sample (n=80), it can be seen that 55.0% (n=44) had worked in a renal dialysis unit for 1 to 4 years, 20.0% (n=16) for 5 to 9 years, 13.8% (n=11) for 10 to 15 years, 6.3% (n=5) for 16 to 20 years, whilst 5.0% (n=4) had worked in a renal dialysis unit for 21 to 31 years. Approximately 75% (n=60) of all respondents fall within the 1 to 9 years of working experience category, whilst 25.1% (n=20) were between 10 to 31 years of working experience. This indicates a need for nurses with more skills and experience. **Figure 4.4** displays the findings.

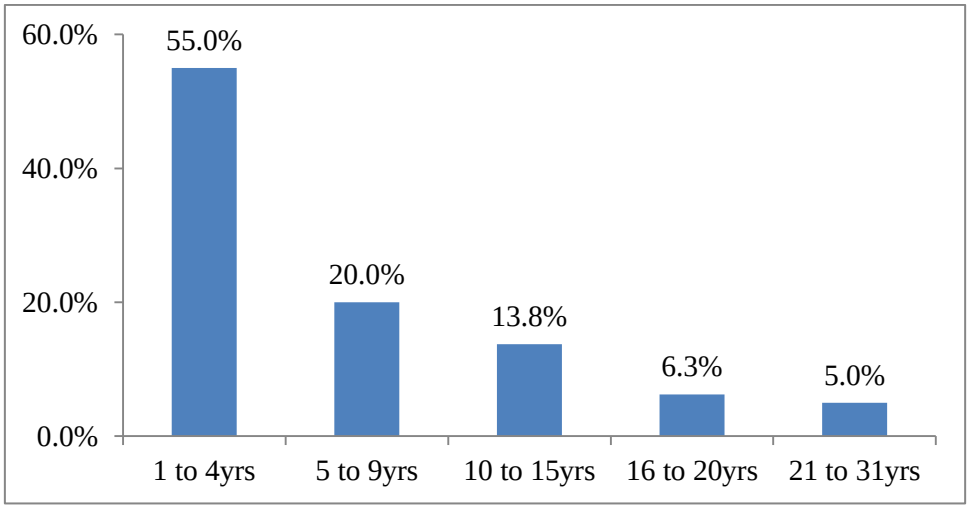


Figure 4.3 Distribution of years of working experience in renal unit (n=80)

In the United States, adverse events occur in 2.9% to 3.7% of hospitalized patients and it is estimated that between 44,000 and 98,000 people die in hospital per annum as a consequence. In a recent meta-analysis conducted across Australia, Canada, the United States and the United Kingdom it was revealed that 43.5% of incidents were preventable while 7.2% of incidents led to deaths (Gillespie, Chaboyer, Wallis & Werder, 2011).

There is a growing recognition of the unique and important contribution that nurses make in the clinical environment to patient outcomes. Research demonstrated a connection between patient outcomes and nurses' education and experience. Quality of care that nurses provide and their level of education and expertise have been identified and skill mix has been associated with patient outcomes such as reduced mortality, length of hospital stay, hospital costs and complications. An Australian study indicated that years of experience and speciality influences nurses' competence (Gillespie, et al., 2011).

4.4.2 Section B: Knowledge of Evidence Based Guidelines

This section comprised of 11 (eleven) items related to nursing practice in the prevention of haemodialysis bloodstream related infections, to which responses were obtained from the respondents by the researcher through a questionnaire. Descriptive statistics were used to analyse interpretation of the data on scale, construct and item levels.

The total sample comprised of 80 (n=80) respondents who were registered nurses working in selected renal dialysis units. The instrument used in this study was developed from the Centre for Disease Control and Prevention (CDC) review Guidelines for the Prevention of Intra-vascular Catheter-related Infections (CDC, 2011). The instrument was a validated and reliable questionnaire, which was developed to evaluate nurse's knowledge of haemodialysis related infection prevention evidence based guidelines (CDC, 2011) and 11 strategies, with relevance to nursing practice in literature to prevent haemodialysis catheter-related bloodstream infection, were listed and respondents had four response alternatives: the correct response and three other alternative responses that were incorrect, which included the choice "I don't know" to avoid respondents playing a chance or gambling and other two choices which investigated preventive value in dialysis catheter-related infections. The second part of this questionnaire asked respondents if they felt

sufficiently informed about the prevention of dialysis catheter-related infections of patients receiving haemodialysis dialysis treatments. Findings are shown in **Figures 4.6 to 4.16**.

4.4.2.1 Hand washing during accessing vascular access

Question 1 focused on basic facts about hand hygiene measures when accessing vascular access sites for preventing haemodialysis catheter-related infections. Respondents received a statement that stated "during accessing vascular access hands should be washed", where they had to choose their responses from a list of four possible responses. The correct response was before and after accessing vascular access, 90.0% (n=72) of nephrology nurses responded correctly. **Figure 4.6** displays the responses obtained:

- 7.5% (n=6) respondents indicated "hands should be washed before accessing vascular access".
- 2.5% (n=2) respondents indicated "hands should be washed after accessing vascular access".
- **90.0% (n=72) respondents indicated "hands should be washed before and after accessing vascular access".**

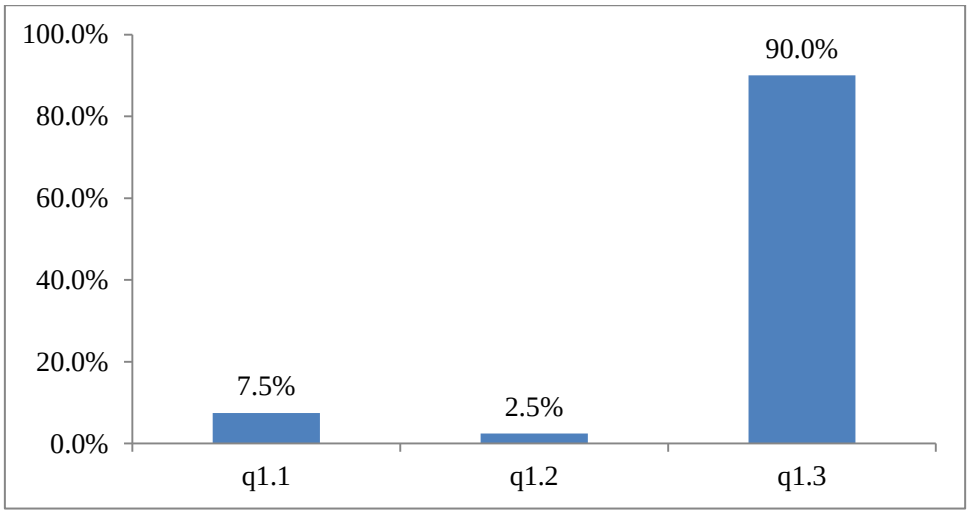


Figure 4.6 Frequencies obtained on hand washing

From the findings, the majority of respondents (90.0%; n=72) indicated that "hands should be washed before and after accessing vascular access" (item q1.3), whilst 7.5% (n=6) and 2.5% (n=2) of the respondents indicated incorrectly that "hands should be washed before accessing vascular access" (item q1.1), and "hands should be washed after accessing vascular access" (item q1.2), respectively. It can be extrapolated from these findings that

90% (n=72) of the respondents are aware of the current evidence based guidelines related to hand washing recommendations, while 10% (n=8) of the respondents were incorrect.

4.4.2.2 Skin cleansing during accessing vascular access

Question 2 focused on basic facts about skin cleansing when accessing vascular access for the prevention of haemodialysis catheter-related infections. The respondents were presented with a statement that "during accessing vascular access skin should be cleaned with", where they had to select their response from a list of four possible responses. The correct response was 2% chlorhexidine and 70% alcohol solution, 91.2% (n=73) of nephrology nurses responded correctly. **Figure 4.7** displays the responses obtained.

- **91.2% (n=73) respondents indicated "the skin should be cleaned with" 2% Chlorhexidine and 70% alcohol solution.**
- 3.8% (n=3) respondents indicated "the skin should be cleaned with" 10% Povidine Iodine.
- 5.0% (n=4) respondents indicated "the skin should be washed with" Chlorhexidine gluconate 0.5%.

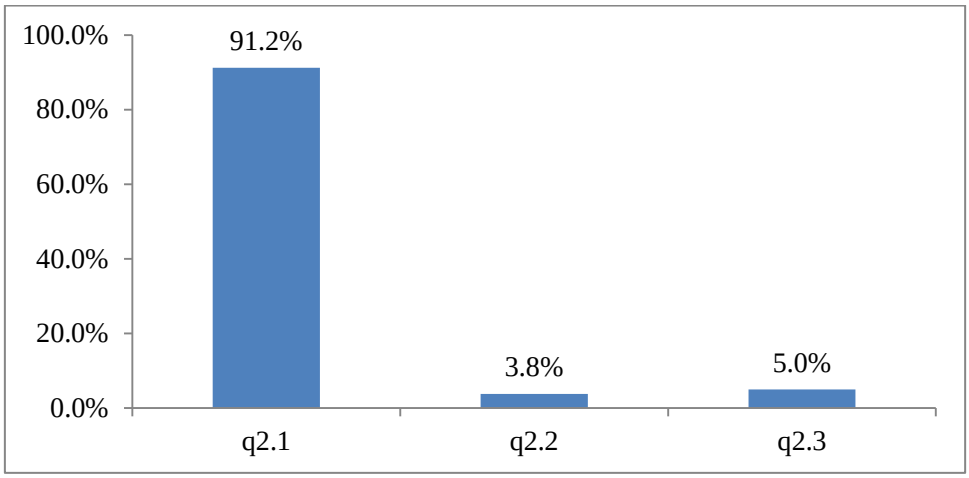


Figure 4.7 Frequencies obtained on skin cleaning

From the findings, the majority of respondents (91.2%; n=73) indicated correctly that skin should be cleaned with 2% Chlorhexidine and 70% alcohol solution (item q2.1), whilst 5.0% (n=4) and 3.8% (n=3) respondents indicated that "the skin should be cleaned with" Chlorhexidine 0.5% (item q2.3) and "the skin should be cleaned with" 10% Povidine Iodine (item q2.2), respectively. It can be extrapolated from these findings that 91.2%

(n=73) of respondents were aware of the current recommended skin cleansing solutions and procedures, while 8.8% (n=7) of the respondents were incorrect.

4.4.2.3 Types of dressings for vascular access exit sites

Question 3 focused on basic facts about type of dressings for vascular access sites for the prevention of haemodialysis catheter-related infections. The respondents were presented with a statement that "what type of vascular access dressing should be used to dress the vascular access exit site", where they had to select their responses from a list of four possible responses. The correct response was both transparent and gauze dressings "should be used to dress vascular access sites", 63.8% (n=51) of nephrology nurses responded correctly. **Figure 4.8** displays results obtained.

- 12.5% (n=10) respondents indicated a transparent dressing "should be used to dress the vascular access".
- 23.8% (n=19) respondents indicated a gauze dressing "should be used to dress the vascular access".
- **63.8% (n=51) respondents indicated both transparent and gauze dressings "should be used to dress the vascular access".**

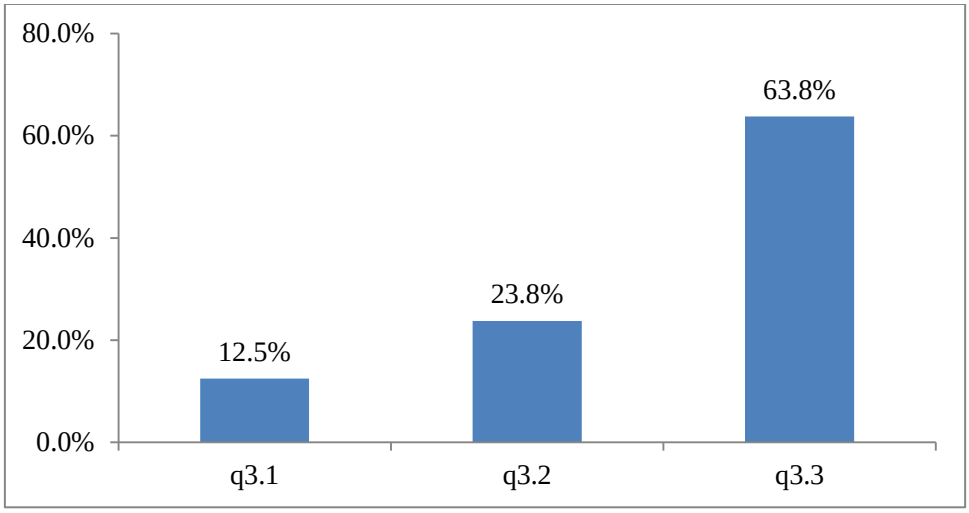


Figure 4.8 Frequencies obtained on dressing used on vascular catheter exit site

From the findings, the majority of respondents (63.8%; n=51) indicated that both transparent and gauze dressings "should be used to dress the vascular access" (item q3.3), while 23.8% (n=19) and 12.5% (n=10) *indicated incorrectly* that a gauze dressing "should

be used to dress vascular access" (item q3.2) and a transparent dressing "should be used to dress vascular access" (item q.3.2), respectively. It can be extrapolated from these findings that 63.8% (n=51) of the respondents were aware of the current dressings required for vascular access, while 36.3% (n=29) of the respondents were incorrect.

4.4.2.4 Removal of vascular access exit site dressing

Question 4 focused on basic facts about removal of dressings for vascular access sites for the prevention of haemodialysis catheter-related infections. The respondents were presented with a statement that when "should vascular access dressing be removed", where they had to select their responses from a list of four possible responses. The correct response was that "vascular access dressing should be removed when damp, soiled or loose", only 6.3% (n=5) of nephrology nurses responded correctly. **Figure 4.9** displays results obtained.

- **6.3% (n=5) respondents indicated "vascular access dressing should be removed when damp, soiled or loose".**
- 35.0% (n=28) respondents indicated "vascular access dressing should be removed on every dialysis appointment".
- 56.3% (n=45) respondents indicated "vascular access dressing should be removed when damp, soiled or loose and on every dialysis appointment".
- 2.5% (n=2) respondents indicated "they were not sure when the vascular access dressing should be removed".

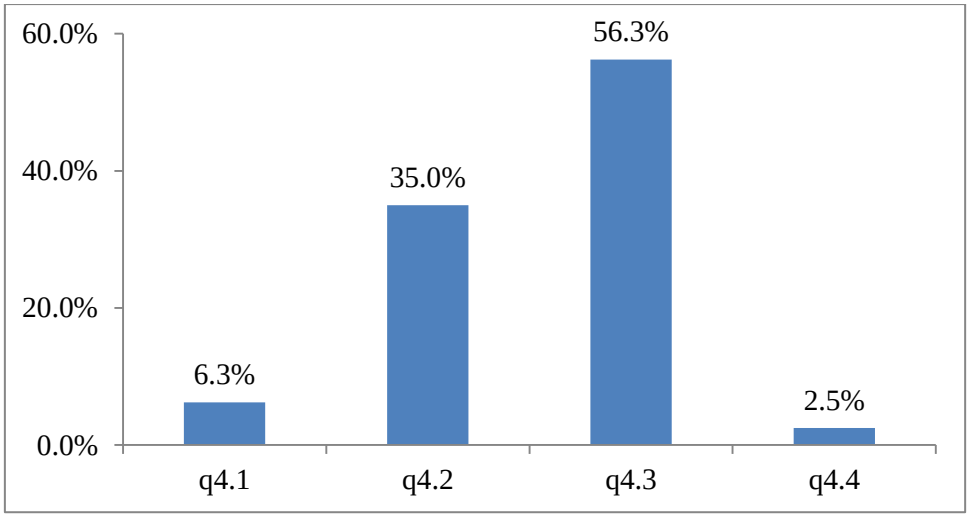


Figure 4.9 Frequencies obtained on dressing removal

From the findings, the minority of respondents (6.3%; n=5) indicated that "vascular access dressings should be removed when damp, soiled or loose" (item q4.1), whilst 56.3% (n=45) of the respondents indicated incorrectly that "vascular access dressings should be removed when damp, soiled or loose and on every dialysis appointment" (item q4.3), 35.0% (n=28) and 2.5% (n=2) respondents *indicated incorrectly* that "vascular access dressings should be removed on every dialysis appointment" (item q4.2) and they were "not sure when the vascular access dressing should be removed" (item q4.4), respectively. It can be extrapolated from these findings that only a minority of respondents (6.3%; n=5) are aware of current recommended vascular access exit site dressings, while a majority (93.8%; n=75) of the respondents were incorrect.

4.4.2.5 Use of antibiotic/antiseptic ointment for vascular access exit sites

Question 5 focused on basic facts about antibiotic/antiseptic ointment for vascular access sites for the prevention of haemodialysis catheter-related infections. The respondents were presented with a statement that "what type of antibiotic/antiseptic ointment should be applied to vascular site to help reduce infection", where they had to select their response from a list of four responses. The correct response was Mupirocin ointment should be used, 68.8% (n=55) of nephrology nurses responded correctly. **Figure 4.10** displays results obtained.

- 10.0% (n=8) respondents indicated "Povidine Iodine ointment is the type of antibiotic/antiseptic ointment that should be applied to vascular site to help reduce infection".
- **68.8% (n=55) respondents indicated "Mupirocin ointment should be used".**
- 16.3% (n=13) respondents indicated "both Povidine Iodine and Mupirocin ointments should be used".
- 5.0% (n=4) respondents indicated "they were not sure".

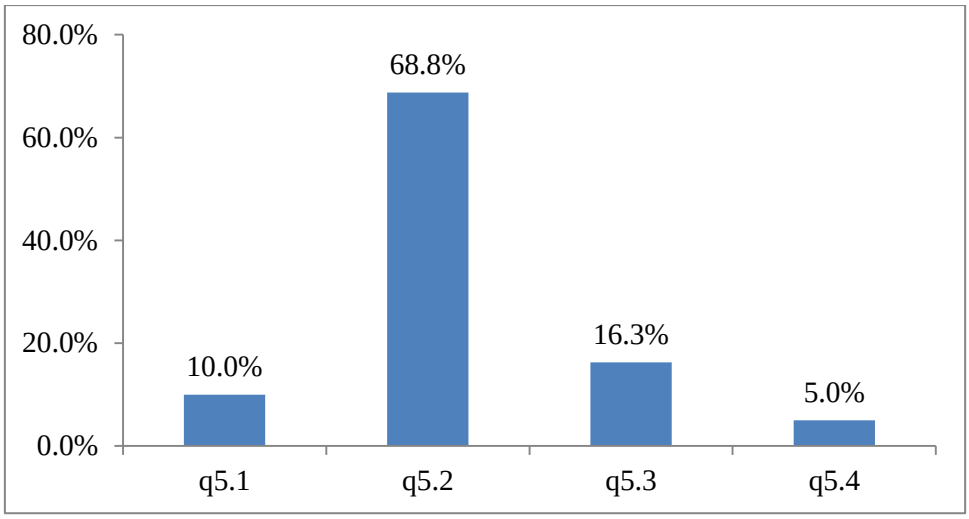


Figure 4.10 Frequencies obtained on the type of antibiotic/antiseptic ointment to be used on exit site

From the findings, the majority of respondents (68.8%; n=55) indicated that "Mupirocin ointment should be applied on vascular catheter exit site" (item q5.2), whilst 16.3% (n=13). 10.0% (n=8) and 5.0% (n=4) of respondents *indicated incorrectly* that "Povidine Iodine ointment is the type antibiotic/antiseptic ointment that should be applied to vascular access" (item q5.1), both "Povidine Iodine and Mupirocin ointment" (item q5.3) should be used and they were unsure (item q5.4), respectively. It can be extrapolated from these findings that majority of respondents (68.8%; n=55) are aware of the current recommended "use of antibiotic/antiseptic ointment for vascular access exit site", whilst 25 (n=25; 31.3%) respondents were incorrect.

4.4.2.6 Use of anticoagulation locks for vascular access catheter lumens

Question 6 focused on basic facts about use of anticoagulation locks which should be instilled into the catheter lumens to prevent clotting for prevention of haemodialysis catheter-related infections. The respondents were presented with a statement that "what anticoagulation lock should be instilled into the patient's catheter lumens to help prevent clotting", where they had to select their responses from a list of four responses. The correct response was "heparin should be instilled into the catheter lumens to help prevent clotting", 100.0% (n=80) nephrology nurses responded correctly. **Figure 4.11** displays results obtained.

- 100.0% (n=80) respondents indicated "heparin is the anticoagulation lock that should be instilled into patient's catheter lumens to help prevent clotting".

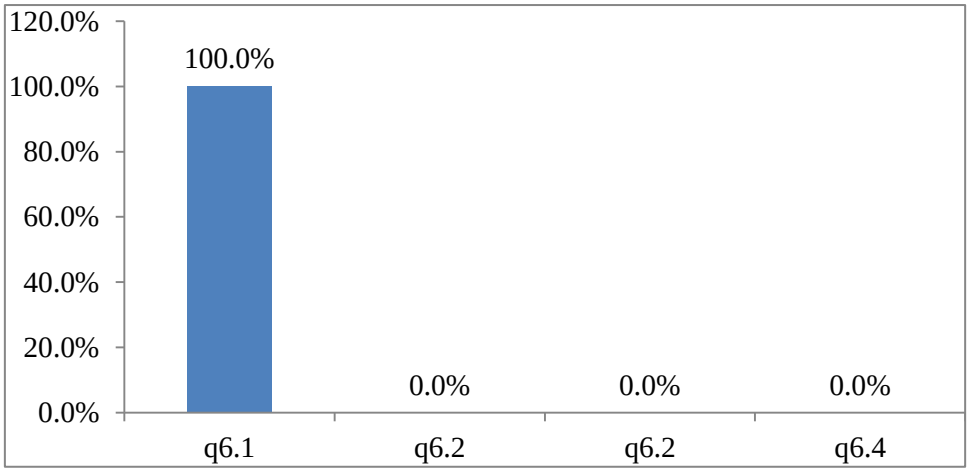


Figure 4.11 Frequencies obtained on anticoagulation lock

From the findings, an overwhelming majority of respondents (100.0%; n=80) indicated that "heparin is the anticoagulation lock of choice that should be instilled into patient's catheter lumens to help prevent clotting" (item q6.1). It can be extrapolated from these findings that the current recommendations for use of anticoagulation locks are followed in clinical practice. This suggests it may be a standard practice in the renal dialysis units because all the respondents correctly indicated this strategy.

4.4.2.7 Checking vascular catheter exit sites

Question 7 focused on basic facts about checking vascular catheter exit sites for signs infection for preventing haemodialysis catheter-related infections. The respondents were presented with a statement that "all vascular catheter exit sites should be checked for any signs of infection", where they had to select their response from a list of four responses. The correct response was "vascular catheter exit sites should be checked before each dialysis session", 56.5% (n=45) of nephrology nurses responded correctly. **Figure 4.12** displays results obtained.

- **56.3% (n=45) respondents indicated "all vascular catheter exit sites should be checked before each dialysis session".**
- 2.5% (n=2) respondents indicated "all vascular catheter exit sites should be checked after each dialysis session".

- 41.3% (n=33) respondents indicated "all vascular catheter exit sites should be checked both before and after each dialysis".

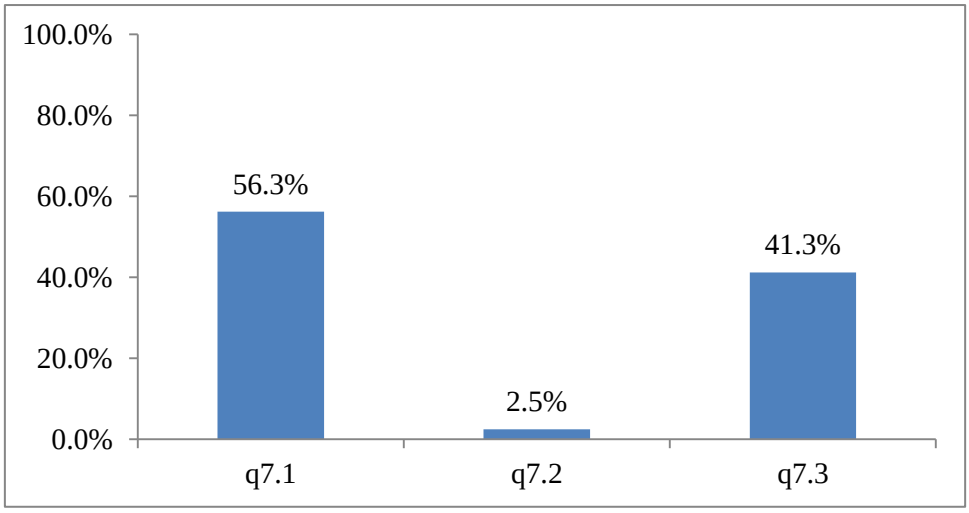


Figure 4.12 Frequencies obtained on checking of vascular catheter exit site

From the findings, the majority of respondents (56.3%; n=45) indicated that "vascular catheter exit sites should be checked before each dialysis session" (item q7.1), whilst 41.3% (n=33) and 2.5% (n=2) of the respondents *indicated incorrectly* that "vascular exit sites should be checked after each dialysis session" (item q7.3), and "vascular exit site should be checked before each dialysis session" (item q7.2), respectively. It can be extrapolated from these findings that majority of respondents are aware of the current recommended guidelines for checking vascular catheter exit site, while 35 (n=35; 43.8%) of the respondents were incorrect.

4.4.2.8 Checking fistula and graft vascular access sites

Question 8 focused on basic facts about checking fistula and graft vascular access sites for swelling and redness for preventing haemodialysis catheter-related infections. The respondents were presented with a statement that "fistula and graft sites should be checked for swelling and redness", where they had to select their response from a list of four possible responses. The correct response was "fistula and graft sites should be checked before and after each dialysis session", 72.5% (n=58) of nephrology nurses responded correctly. **Figure 4.13** displays results obtained.

- 26.3% (n=21) respondents indicated “fistula and grafts should be checked for swelling and redness before each dialysis session”.
- 1.3% (n=1) respondents indicated “fistula and grafts should be checked after each dialysis session”.
- **72.5% (n=58) respondents indicated “fistula and grafts should be checked before and after each dialysis session”.**

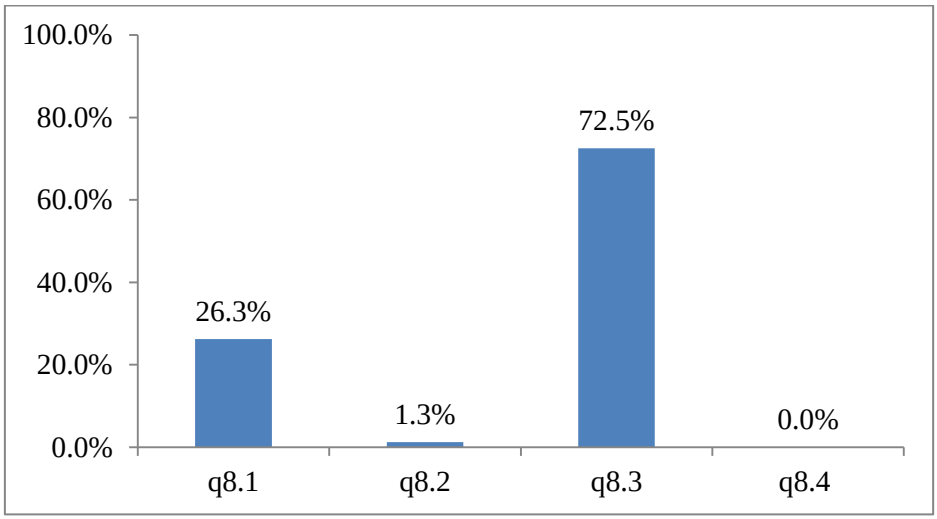


Figure 4.13 Frequencies obtained on checking of fistula and grafts

From the findings, the majority of respondents (72.5%; n=58) indicated that “fistula and grafts should be checked for swelling and redness before and after each dialysis session” (item q8.3), whilst 26.3% (n=21) and 1.3% (n=1) of the respondents *indicated incorrectly* that “fistula and grafts should be checked before each dialysis session” (item q8.1) and “fistula and grafts should be checked after each dialysis session” (item q8.2). It can be extrapolated from these findings that majority of the respondents are aware of the current recommended guidelines for “checking vascular access catheter dressings”, while only 8 (n=8; 10.0%) of the respondents were incorrect.

4.4.2.9 Changing vascular access catheter dressings

Question 9 focused on basic facts about changing vascular catheter dressings for preventing haemodialysis catheter-related infections. Respondents received a statement that “vascular catheter dressings should be changed”, where they had to select their response from a list of four possible responses. The correct response was “vascular catheter

dressings should be changed before the patient is connected to dialysis", 90.0% (n=72) of nephrology nurses responded correctly. **Figure 4.14** displays the results obtained.

- **90.0% (n=72) respondents indicated "vascular catheter dressings should be changed before the patient is connected to dialysis".**
- 10% (n=8) respondents indicated "vascular catheter dressing should be changed during connection to dialysis".

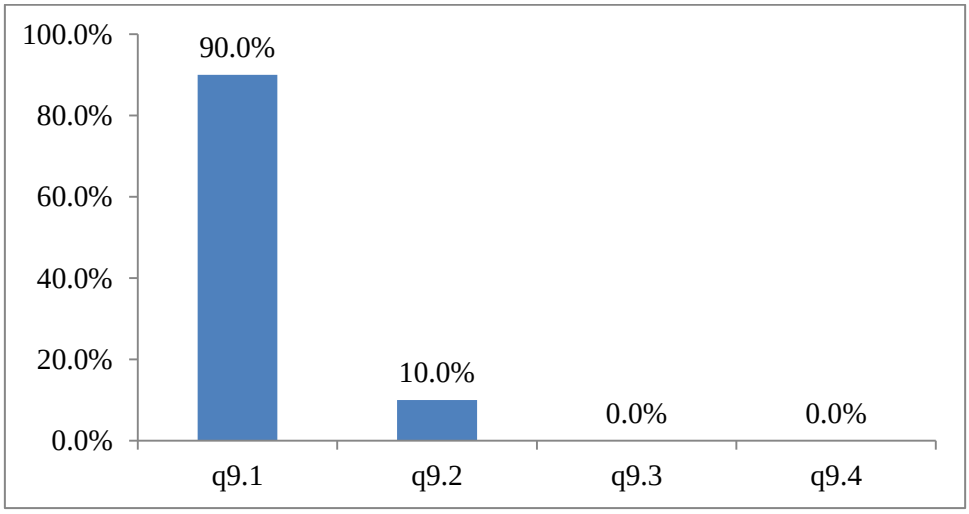


Figure 4.14 Frequencies obtained on when to change vascular catheter dressing

From the findings, the majority of respondents (90.0%; n=72) indicated that "vascular dressings should be changed before the patient's connection to dialysis" (item q9.1), whilst 8 (n=8; 10.0%) respondents *indicated incorrectly* that "vascular catheter dressings should be changed during connection to dialysis" (item q9.2). It can be extrapolated from these findings that majority of the respondents are aware of the current recommended guidelines for "changing vascular access dressing before connection to dialysis", whilst only 12 (n=12; 10.0%) of the respondents were incorrect.

4.4.2.10 Use of protective clothing by nursing staff

Question 10 focused on basic facts about use of protective clothing by nursing staff for preventing haemodialysis catheter-related infections. Respondents received a statement that "what protective clothing should staff wear for preventing haemodialysis catheter-related infections", where they had to choose their responses from a list of four possible responses. The correct response was "gloves, face masks and goggles must be used",

85.0% (n=68) of nephrology nurses responded correctly. **Figure 4.15** displays the results obtained.

- 15.0% (n=12) respondents indicated "face masks and gloves must be used".
- **85.0% (n= 68) respondents indicated "gloves, face masks and goggles must be used".**

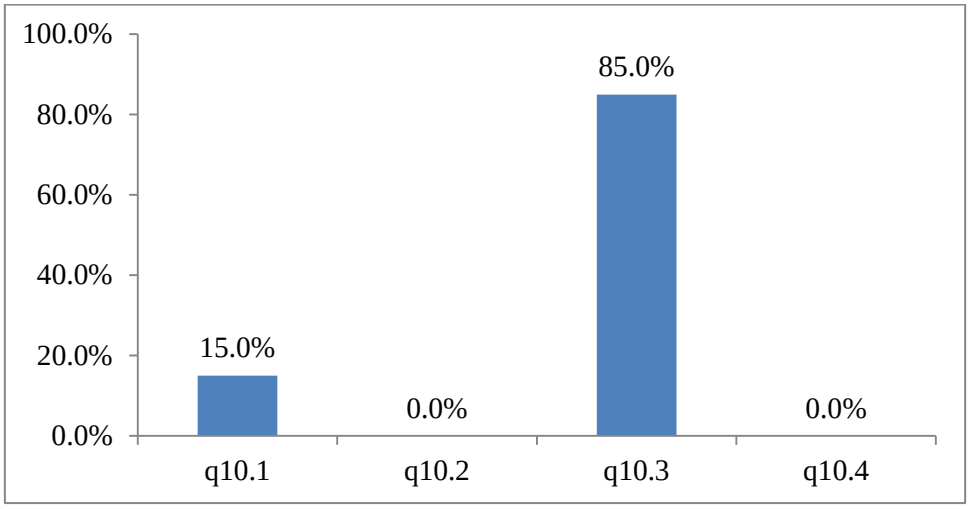


Figure 4.15 Frequencies obtained on the use of protective clothing by nursing staff

From the findings, the majority of respondents (85.0%; n=68) indicated that "gloves, face masks and goggles must be used" (item q10.3), whilst 12 (n=12; 15.0%) respondents *indicated incorrectly* that "face masks and gloves must be used" (item q10.1). It can be extrapolated from these findings that majority of the respondents are aware of the current recommended guidelines for "use of protective clothing by nursing staff", whilst only 12 (n=12; 10.0%) of the respondents were incorrect.

4.4.2.11 Avoidance of cross contamination for haemodialysis patients

Question 11 focused on basic facts about advice the patient should receive to avoid contamination of vascular catheter exit site for preventing haemodialysis catheter-related infections. Respondents received a statement that "what advice should be to the patient to avoid cross contamination of the vascular catheter exit site through the mouth and nasal flora", where they had to choose their responses from a list of four possible responses. The correct response was "patients must minimise talking and look away from the vascular

access site", 61.3% (n=49) of nephrology nurses responded correctly. **Figure 4.16** displays the results obtained.

- 18.8% (n=15) respondents indicated "patients must minimise talking".
- 20.0% (n=16) respondents indicated "patients must look away from the vascular access exit site".
- **61.3% (n=49) respondents indicated "patients must minimise talking and look away from the vascular access exit site".**

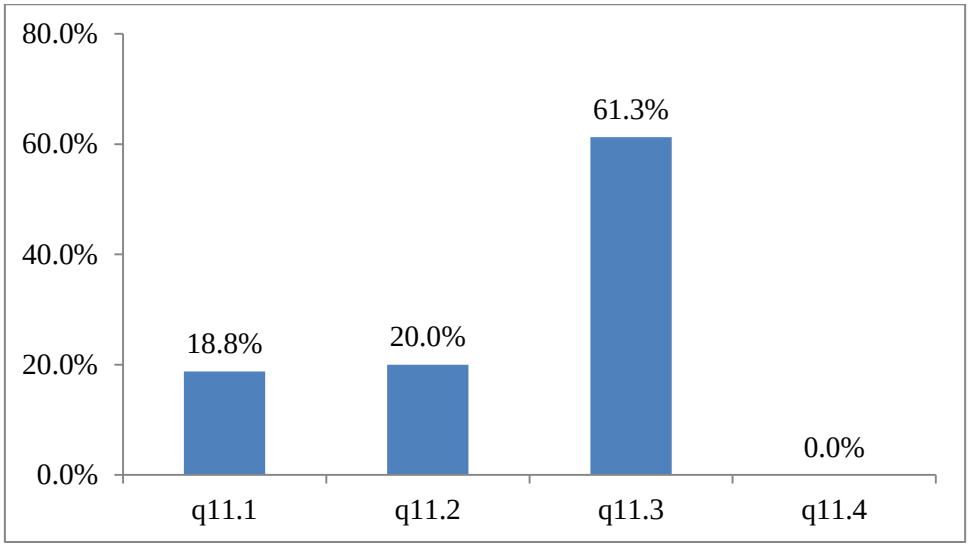


Figure 4.16 Frequencies obtained on advice for patient's to avoid cross contamination

From the findings, the majority of respondents (61.3%; n=49) indicated that "patient's should minimise talking and look away from the vascular access site" (item q11.3), whilst 20.0% (n=16) and 18.8% (n=25) of the respondents *indicated incorrectly* that "patients must minimise talking" (item q11.2) and "patients must look away from the vascular access exit site" (item q11.1), respectively. It can be extrapolated from these findings that the majority of respondents are aware of the current recommended guidelines for "advice given to patients to prevent cross contamination", whilst 38.8% (n=41) of the respondents were incorrect.

4.4.2.12 Level of knowledge about haemodialysis related catheter infections

The second part of Section B in the questionnaire related to respondent's objective opinion about the level of knowledge for preventing haemodialysis dialysis related catheter

infections. Respondents received a statement that asked "whether they felt sufficiently informed about the prevention of dialysis catheter-related infections", where they had to choose their response from a list of two responses. In addition, respondents were given an option to elaborate on their response in an open-ended section. **Figure 4.17** displays the results obtained.

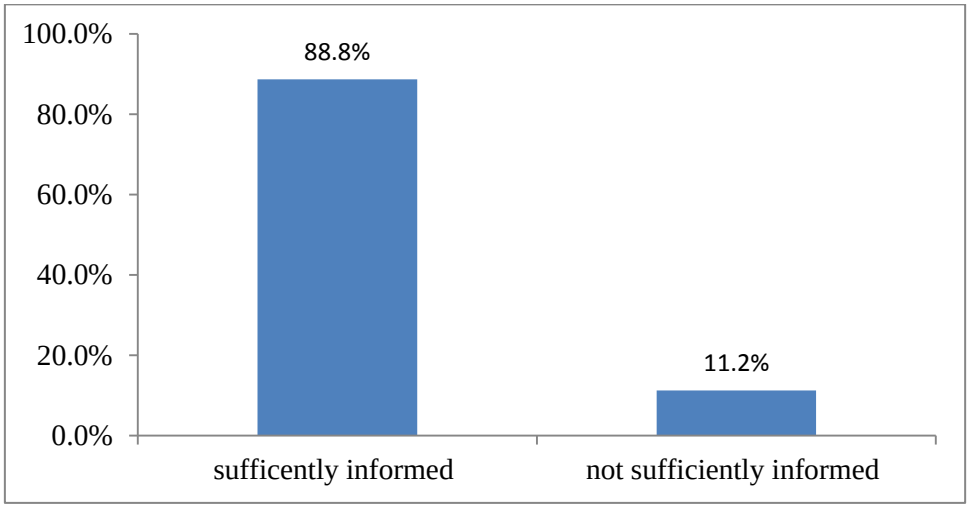


Figure 4.17 Frequencies obtained from respondents for level of knowledge for preventing haemodialysis catheter-related infections.

From the findings, the majority of respondents (88.8%; n=71) indicated that "they felt sufficiently informed about the prevention of haemodialysis catheter-related infections", whilst only 9 (n=9; 11.2%) of all respondents felt that "they were insufficiently informed". Of those respondents (88.8%; n=71) who felt "sufficiently informed about haemodialysis catheter-related infections", they reported having obtained knowledge from their own post basic training at the nursing college, attending lectures provided by infection control services, in-service hospital training, as well as scientific conferences. It can be extrapolated from these findings that the majority of respondents felt "sufficiently informed about haemodialysis catheter-related infections", while only 9 (n=9; 11.2%) of the respondents felt insufficiently informed. Moreover, it was suggested that the respondents felt sufficiently informed by obtaining multiple sources of knowledge.

4.4.3 Correlations between Experience Levels and Knowledge

Construct scores and total questionnaire scores were of interest for further analysis to compare results with the categorical variables. Measurement of central tendency and variation (mean [M] and standard deviation [SD]) were used to summarise the data. Findings for selected respondent demographic variables are discussed in the next section. Summary of frequencies for comparison of respondent's years of experience and level of knowledge performance are displayed in **table 4.3**.

In the first item of interest, the total questionnaire scores for level of knowledge (performance) was re-organised under three (3) headings namely: 1=good (71% and above), 2=average (50 to 70%), 3=poor (0 to 50%). **Table 4.3** displays the results obtained.

Table 4.3 Summary of respondents total scores for level of knowledge by years of experience (n=80)

Years of experience	Level of Knowledge		
	Poor (0 to 50%)	Average (50 to 70%)	Good (>71% and above)
0 to 5 years	1	12	35
6 to 10 years	1	1	15
11+	0	7	8
Totals	2	20	58
	2.5%	25.0%	72.5%

From the findings (table 4.4) of the total level of knowledge scores it can be seen that 72.5% (n=58) of the respondents performed well and achieved more than 71%, 25% (n=20) performed averagely and achieved between 50 to 70%, whilst 2.5% (n=2) performed poorly and achieved between 0 and 50%.

Based on the variations in the level of knowledge scores by years of experience seen in table 4.4, further testing was done for significance. The number of participants in this study was 80 (n=80). A scatterplot has been used to illustrate dispersion of these values on the

variable (years of experience). From the total number of respondents (n=80), mean years of experience was 7.06 and the SD was 6.81, while mean level of knowledge performance was 0.75 and the SD was 0.12. **Figure 4.18** displays the results obtained.

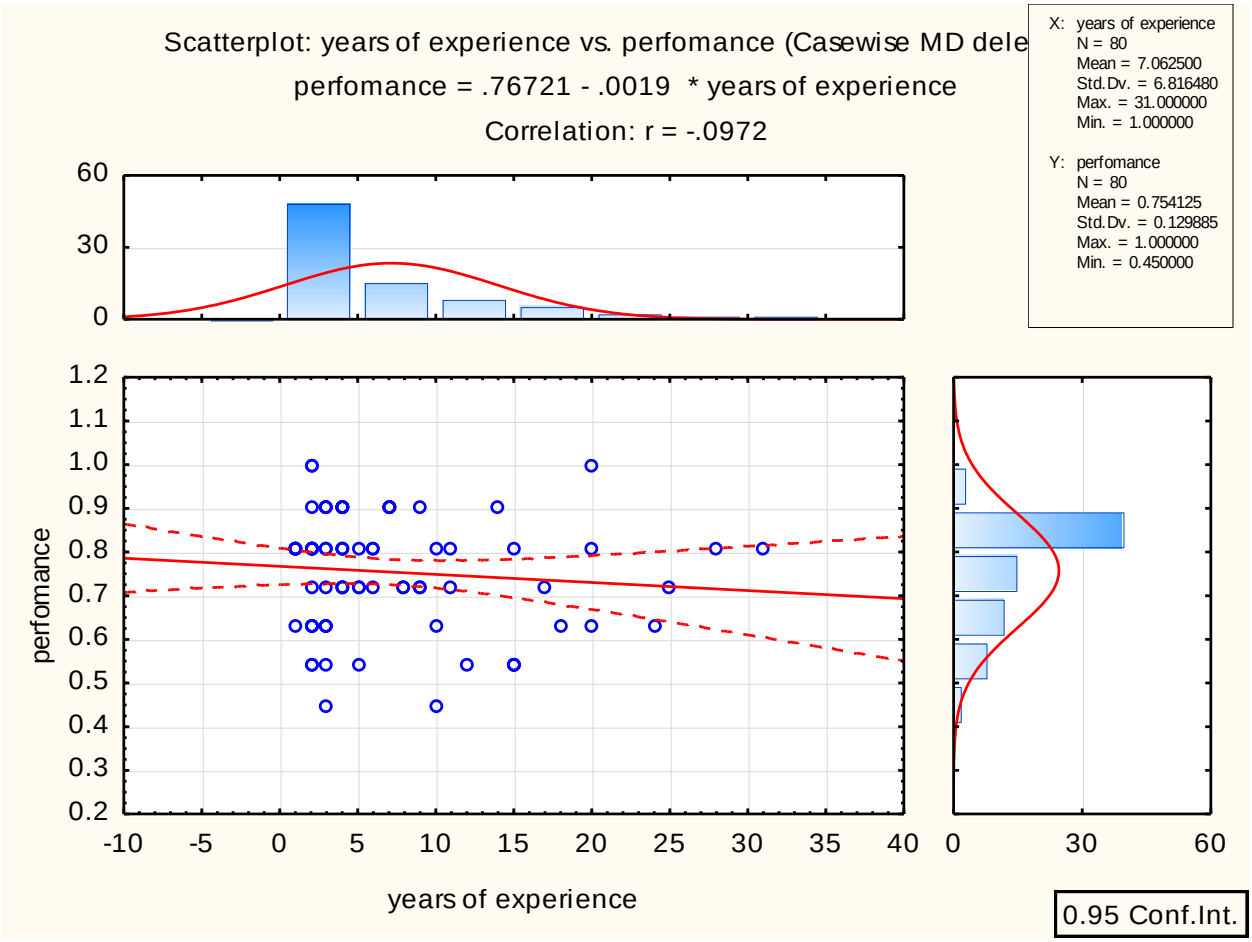


Figure 4.18 Correlation for years of experience by level of knowledge performance (n=80)

The scatterplot signifies a slight negative correlation which is very weak (null correlation). Most of the respondent's responses lie below the regression line. Therefore years of experience working in the renal dialysis unit has nothing to do with level of knowledge performance. **Figure 4.18** displays the results obtained.

4.4.4 Correlations between Age and Levels of Experience

Based on the variation in the frequency scores, further testing was done for significance. Measures of central tendency (mean and standard deviation) were used to show these differences. The mean age of respondents (n=80) was 42.4 years and the standard

deviation (SD) was 9.21, while the mean of respondents years of experience was 7.06 and SD was 6.81. **Figure 4.19** displays the results obtained.

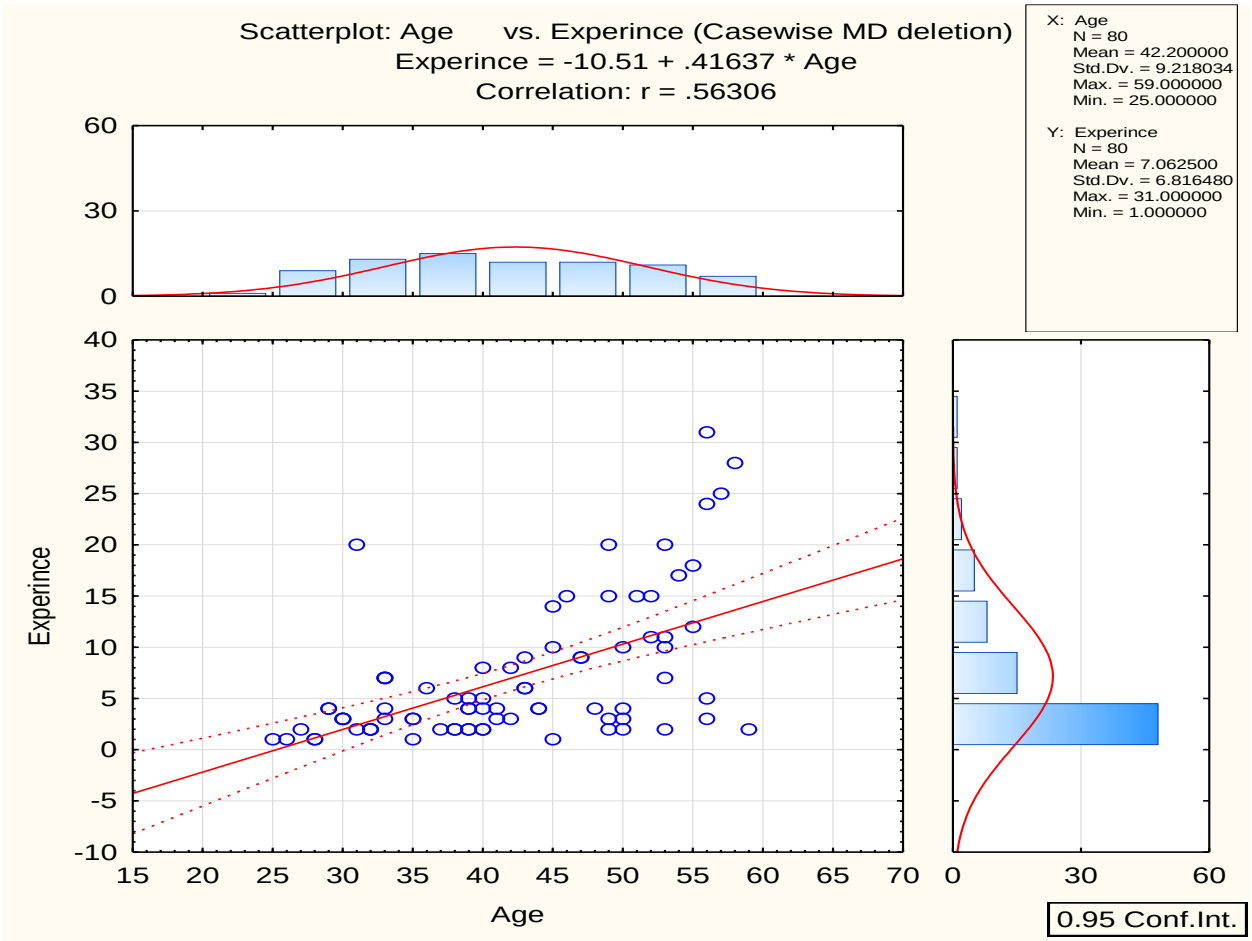


Figure 4.19 Correlation for age and years of experience

From the findings, the number of respondents who participated in this study was 80 (n=80). A scatterplot was used to illustrate the dispersion of values on the variable (years of experience). The correlation coefficient is usually between -1.0 and +1.0 where close to -1.0 or +1.0 is a strong relationship, >0.70 are strong relationships, less than 0.3 are weak and between 0.3 and 0.70 are moderate (Polit & Beck, 2010). The histogram shows an abnormal distribution because there are outliers. It also signifies a positive correlation (with moderate strength) between age and experience (r=0.563). Therefore as experience increases the level of knowledge performance will also increase moderately. **Figure 4.19** displays the results.

4.5 DISCUSSION OF RESULTS

The purpose of this study was to determine nephrology nurses' knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related infection in the renal dialysis unit from two university-affiliated, public sector hospitals.

Of the total sample (n-80), females accounted for 81.3% (n=65), whilst males accounted for 18.8% (n=15) showing a largely female dominated sample. The average age obtained for respondents was 42.4 years. More than half of the respondents (58.8%; n=47) were in the 40 to 59 age group, implying in terms of age distribution this is a mature nursing population. More than half of the respondents had a post basic diploma in nephrology (56.3%; n=45), whilst slightly less than half (43.8%; n=43) of the respondents were not trained in the speciality. Whilst most of the respondents (55.0%; n=44) had worked in the renal dialysis unit for a period of 1 to 4 years, twenty (25.1%) respondents had from 10 to 31 years of clinical experience.

Findings in this study revealed the mean percentage of knowledge scores was as follows: 72.5% (n=58) of the respondents performed well and achieved more than 71%, 25% (n=20) performed averagely and achieved between 50 to 70%, whilst 2.5% (n=2) performed poorly and achieved between 0 and 50%. These findings may suggest higher baseline level of knowledge regarding catheter care for respondents in the present study compared to respondents in previous studies. In the study of Csomos, Orban, Konczne, Reti, Vas and Darvas (2008) a mean test score of 3.66 (n=178) was reported, whilst Labeau *et al.* (2009) reported a mean test score of 4.44 (n=3405).

Related to **hand hygiene**, 90.0% (n=72) of respondents chose the option that hands should be washed before and after accessing vascular access. These results are similar to studies conducted internationally, whereby Creedon (2005) reported levels of knowledge appeared to be quite good as no less than 79% and up to 91% of nurses correctly identified specific guidelines for hand washing in their study, other studies also reported results within this range (Abelsatir, 2013; Zingg, Imhof, Maggiorinini, Stocker, Keller & Ruef, 2009). Another study, found nurses prepared through a bachelor's degree programme tended to be more adherent to hand hygiene (72.5% versus 42.9%, p=0.1) and the use of gloves (100% versus 85.7%, p=0.01) compared to nurses with a diploma level of education but the results

were not significant (Al Salmi & Kadium, 2014). In this current study, the use of protective clothing as related to sterile barrier precautions, which included gloves, face mask and goggles was chosen by 85.0% (n=72) of the respondents, whilst only 12 (n=12; 12.0%) respondents selected an alternative option indicated as the use of gloves and masks. These results differ from one study by Richard, Courtney and Webster (2004), and indicated as 57% for wearing gloves (sterile and non-sterile) and 14% for wearing masks.

Related to **disinfection** of vascular catheter access site, the majority of respondents (91.2%; n=73) knew that Chlorhexidine is the solution of choice to disinfect the skin; only a small number of respondents (5.0%; n=4 and 3.8%; n=3) chose either Chlorhexidine 0.5% solution or 10% tincture of Povidone Iodine, respectively. These findings are similar to a large multi-national study conducted by Labeau *et al.* (2009), whereby it was reported that 90% of their sample chose chlorhexidine, but only 10% knew the appropriate concentration was a 2% solution. In some countries Chlorhexidine is not available or sporadically available (Higuera, Rosenthal, Duarte, Ruiz, Franco & Safdar, 2005; Rosenthal, Guzman, Pessotto & Crnich, 2003) and some patients may be allergic to chlorhexidine. In this current study, more than 90% of respondents chose Chlorhexidine and knew a 2% solution was required.

Related to vascular **access site dressings**, most of the respondents in this study chose use of both transparent and gauze dressings as acceptable (63.8%; n=51) in covering the vascular catheter insertion site. This finding is higher than one study conducted in Hungary whereby Csomos Orban *et al*. (2008) reported approximately 35% of respondents recognised that both polyurethane and gauze dressings are acceptable choices, but similar findings in a large multi-national study conducted by Labeau *et al*. (2009) that reported 62.6% (n=3405) of their respondents favoured this option. However, in the current study, 23.8% (n=19) of the respondents chose a gauze dressing as acceptable, compared to 10% (Labeau, Vandijck, Claes & Blot, 2008) and 26% (Labeau, et al., 2009) and Rickard, Courtney & Webster (2004) in previous studies. Because of its simplicity and functionality, the practice of using both transparent and gauze dressing is followed in accordance with the CDC guidelines as evidenced by multi-national data.

Related to **antibiotic/antiseptic ointment**, 68.8% (n=55) of respondents chose application of Mupirocin at the insertion site to help reduce infection, whilst 16.3% (n=13) and 10.0%

(n=8) of respondents chose Povidine Iodine ointment and both Povidine Iodine and Mupirocin ointment as acceptable options, respectively. These results differ from the previous reports of 14% by Csomos Orban *et al*. (2008) and 30% by Labeau *et al.* (2008) and Labeau *et al.* (2009). In the current study area, it is the policy of the CDC to recommend application of antibiotic/antiseptic ointment prophylaxis because of high infection risk in this population group (CDC, 2011), and supported as best practice for patients on renal replacement treatments (Vanholder, Canaud, Fluck, Jadoul, Labriola, Marti-Monros, Tordoir & Van Biesen, 2010). Mupirocin is the most commonly used antibiotic/antiseptic ointment prophylaxis in the renal dialysis units (Vanholder, et al., 2010).

Related to **anti-coagulation locks** to prevent clotting, all (100%; n=80) of the respondents in this study chose heparin as the acceptable option. In the current study area, it is the policy of the CDC to recommend the use of heparin anticoagulation locks instilled into patient's catheter lumens to prevent clotting between dialysis sessions (CDC, 2011). Its use is supported in a position statement of European Renal Best Practice (Vanholder, *et al.*, 2010) and one study conducted by systematic review (Vandijck, Labeau, Secanell, Rello, & Blot, 2009).

Related to **active surveillance**, 41.3% (n=33) of respondents thought the option of checking vascular catheter exit sites before each dialysis session was acceptable. These results differ from studies conducted overseas (USA and UK), whereby Berenholtz, Pronovost, Lipsett, Hobson, Earsing, Farley, Milanovich, Garrett-Mayer, Winters, Rubin, Dorman & Perl (2004), and Pronovost, Goeschel, Colantuoni, Watson, Lubomski, Berenholtz, Thompson, Sinopoli, Cosgrove, Sexton, Marsteller, Hyzy, Welsh, Posa, Schumacher and Needham (2008) reported that active surveillance for catheter-related bloodstream infections positively impacts on the number of catheter-related bloodstream infections. In this current study, 56.3% (n=45) of respondents indicated vascular catheter exit sites should be checked before and after each dialysis session was acceptable, These results are consistent with recommendations of the CDC, whereby it is stated that "catheter sites should be monitored daily (*regularly*), visually or by palpation for manifestations such as warmth, tenderness, swelling, erythema, pus or redness, suggesting local inflammation or catheter-related bloodstream infections" (CDC, 2011). In addition, a higher number of respondents (n=58; 72.8%) in this current study indicated that fistulas

and grafts should be checked for swelling and redness before and after each dialysis session.

Related to **dressing changes**, only a small number (n=5; 6.3%) of respondents thought the option of removal of vascular access dressings when damp, soiled or loose was acceptable. These results differ from the studies conducted by Labeau, *et al.* (2009), Csomos Orban *et al.* (2008), Rickard *et al.* (2004) and Chen *et al*. (2015) reported as 43.4%, and 85.0%, 18.8%, respectively. The CDC guidelines advise "dressings should be replaced if they are damp, loose or soiled *or for site inspection"* (CDC, 2011). In this current study, 56.3% (n=45) of respondents indicated dressings should be removed when damp, soiled or loose and *on every dialysis appointment* was acceptable. These results may suggest nurse respondents seem convinced of an excessive need to change dressings at the catheter site. Frequent dressing changes may have a negative impact on patient's comfort (Vandijck, *et al.,* 2009). Another study demonstrated "frequent dressing disruptions may increase the risk of catheter-related bloodstream infections by three-fold after the second dressing disruption and by more than ten-fold if the dressing was disrupted, independently of other risk factors of infection" (Timsit, Boudadma, Ruckly, Schwebel, Garrouste-Orgeas, Bronchard, Calvino-Gunther, Laupland, Adrie, Thuong, Herault, Pease, Arrault & Lucet, 2012).

Related to **prevention of cross contamination**, 61.3% (n=49) of the respondents chose the option that patients should minimise talking and look away from the vascular access site, whilst 20.0% (n=25) and 18.8% (n=16) of the respondents thought the option of either no talking or looking away from the vascular access site was acceptable, respectively. Up to 76% of patients on dialysis in different dialysis centres are *Staphylococcus aureus* nasal carriers (Linberg & Lindberg, 2010). This finding is slightly higher than one study conducted in Ireland, whereby Higgens and Evans (2008) reported 53% of respondents stated that they advised patients to minimise talking and look away from the vascular access site. Interestingly, 9% of respondents in the study (Higgens & Evans, 2008) reported that patients wear face shields.

Related to respondents' **objective opinion of knowledge** for preventing haemodialysis catheter-related bloodstream infections, most (88.8%; n=71) of the respondents felt sufficiently informed about the guidelines and care standards. In addition, they reported

having acquired this knowledge from post basic training at the nursing college, attending lectures provided by infection control services, in-hospital training as well as conferences.

4.6 SUMMARY

This chapter discussed results obtained from the study, with descriptive and correlational statistics employed to describe and analyse the data. The research findings are discussed and integrated with findings from literature.

The following chapter will discuss the limitations of the study, research findings, conclusions and recommendations for further research.

CHAPTER FIVE

SUMMARY OF THE STUDY, MAIN RESULTS, LIMITATIONS AND CONCLUSIONS

5.1 INTRODUCTION

The concluding chapter of the research report presents the summary of the study, main findings are discussed, and the limitations are described. This is followed by recommendations for clinical nursing practice, education, the institution and further research based on the results arising from the study.

5.2 SUMMARY OF THE STUDY

5.2.1 Purpose of the Study

The purpose of this study was to determine nephrology nurses' knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related bloodstream infections in the renal dialysis units from two university-affiliated, public sector and tertiary level hospitals in Gauteng.

5.2.2 Objectives of the Study

The objectives of the study were to:

- Validate the instrument, *"Evaluation questionnaire concerning nurses' knowledge of interventions for prevention of haemodialysis catheter-related bloodstream infections"* to evaluate nurses knowledge on evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections.
- Determine and describe nurses' knowledge of evidence-based guidelines for prevention of haemodialysis catheter-related bloodstream infections in the renal dialysis units of the two public sector institutions in Gauteng.

- Establish whether there is a relationship between age, years of experience and knowledge of nurses on evidence-based guidelines for haemodialysis catheter-related bloodstream infections.

5.2.3 Methodology

Face and content validation of the research instrument was done by a panel of experts to ensure suitability of the data collection instrument for South Africa. Before commencement of the study, ethical clearance and permission to conduct the study was obtained from the relevant authorities and the university committee. A non-experimental, descriptive, cross-sectional design was utilised to meet the objectives of the study. Following a consultation with a statistician a sample of 80 participants was decided upon to constitute an adequate and representative sample size.

Data collection was conducted during December 2013 and January 2014. Following a second consultation with the statistician, descriptive statistics were used to analyse the data.

The Committee for Research on Human Subjects (Medical) of the Witwatersrand (protocol number M130921) (Appendix H) granted ethical clearance before commencement of the study. Permission to conduct the study was granted by the Faculty of Health Science Postgraduate Committee and the CEO's of the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) (Appendix I) and Chris Hani Baragwanath Academic Hospital (CHBAH).

Five renal at two tertiary level institutions were used to conduct the study. A statistician was consulted prior to data collection and a sample size of 80 was decided to be acceptable. Statistical significance of the data was tested at the 0.5 (p=0.5) level.

To test the feasibility of the study, understanding of the information letter, informed consent and the questionnaire, pre-testing was conducted with five participants, who were interviewed prior to commencement of the main study. The questionnaire used in the study was developed from the Centre for Disease Control and Prevention (CDC) *"Guidelines for the Prevention of Intravascular Catheter-related Bloodstream Infections"*(CDC, 2011),

which is an open source document to formulate a research instrument. The questionnaire comprised of 11 items, with a predominant 4-point Likert scale. The correct response, three incorrect alternatives which included the choice "I don't know" to avoid participant's taking a chance or gambling, investigated the preventive values of haemodialysis catheter-related bloodstream infections. To elicit suggestions and comments one open-ended question was included at the end of the questionnaire. No additional comments were made by the respondents that were not already included in the questionnaire.

To meet the study's objectives a quantitative, descriptive research design was used. Descriptive statistics were used to analyse the data which was done in consultation with a statistician.

5.3 SUMMARY OF MAIN RESEARCH FINDINGS

The purpose of this study was to determine nephrology nurses knowledge of evidence-based guidelines for the prevention of haemodialysis catheter-related bloodstream infections in the renal dialysis units from two university-affiliated, public sector and tertiary level hospitals in Gauteng.

- Generally nephrology nurses have knowledge of evidence based guidelines for prevention of vascular catheter related infections.

According to Fink (2005) several studies done propose that generally nurses have a positive attitudes and belief their practice should be based on research but irrespective of their knowledge to value and importance of research, most of nurses do not integrate research findings into their practice. 'lack of administrative support and mentorship' nurses cites things such as' inadequate basic research knowledge, lacking of authority to change practice, insufficient time to implement change and incomprehensible stats' are important barriers to nurses use of research in practice' (Fink, 2005).

- There is no correlation between years of experience and knowledge of nephrology nurses on evidenced based guidelines for prevention of catheter related infections.

Phillips (2015) reported that practice and knowledge towards evidence based practice is influenced meaningfully by the level of education. An important attitude towards evidence based practice is shown by nurses in possession of a Bachelor or higher educational trainings and having more clinical experience as compared to those with diploma and associate educational training. Senior nurses are confident to implement changes related to patient care procedures accessed from evidence while junior nurses with less clinical experience relied on material learned in nursing school and skills acquired in their training.

- There is a correlation between age and experience of nephrology nurses on evidenced based guidelines for prevention of catheter related infections.

5.4 CONCLUSION

Objective one was met as the instrument was validated by panel of experts and found to be valid to be used in the South African context.

The second objective of the study was to determine and describe nurses' knowledge of evidence based guidelines for prevention of dialysis catheter related infections. Knowledge was reorganised as poor (0-50%), average (50-70%) and good (71% and above). Overall, participants performed well in the second part of the questionnaire where their knowledge was tested regarding evidence based guidelines in prevention of vascular access infection, where the majority (72.5%: n=58) scored more than 71%, indicating they have knowledge of evidence based guidelines on prevention of vascular access infection, 20% of participants scored between 51 and 70%, indicating lack of knowledge of evidence based guidelines on prevention of vascular access infection does requiring further training, whilst only 2% scored below 50%.

The second objective of the study was to determine possible contributors to the implementation of evidence based guidelines for prevention of dialysis catheter related infections. Even though nurses performed well, there is still a need for on-going development of nurses in renal unit in terms of guidelines for prevention of vascular access infection. The majority of nurses (88.75%: n=71) said they were sufficiently informed about the measures for prevention of vascular access infection, while 11.25% said they

were not, indicating a need for on-going education of nurses on measures for prevention of vascular access infection.

The third objective of the study was to establish whether there is any correlation between training, years of experience and knowledge of nurses on evidence based guidelines of dialysis catheter related infections. The results of the study show a positive correlation (with moderate strength) between age and experience (r=0.563) was established, indicating that as age increases, experience will also increase moderately whilst a slight negative correlation, which was very weak (null correlation), was established between years of experience and performance as most respondents lie above and below the regression line. Therefore years of experience has no influence on performance.

5.5 LIMITATIONS OF THE STUDY

The following were identified as limitations to the study:

The findings of the study cannot be generalised to other populations as the study was contextual and conducted in only two hospitals in one province.

The rating scales used in this study were set low; the cut-off point for knowledge was 70% instead of 80% as in other studies that where done. Evidence Based Practice is based on outcomes, hence the higher the score the more likely the action will be more effective. The instrument was narrow and did not request more information on how these strategies were implemented. For example use of antibiotic ointment did not ask for reason i.e. antibiotic resistance. Type of dressing may have been confusing to the respondents because the CDC recommends both types.

5.6 RECOMMENDATIONS OF THE STUDY

Evidence based practice and quality of care for renal patients' is emphasized in the study. The following recommendations are made in relation to nursing practice, education and further research.

5.6.1 Clinical Nursing Practice

There is a need for a constant updating of new information for development of skills to provide quality care to patients. On-going development in the nurses' careers is needed in order for them to remain updated with current knowledge and skills.

The following recommendations are made:

- New staff members need to be oriented in educational strategies for prevention of Evidence Based Practice on vascular access infection and CDC guidelines
- Continuous in-service training and update on current trends in practice need to be done in the renal dialysis centres' to improve knowledge on prevention of vascular access infection.
- Regular update of unit infection control policies to be done and staff to be educated on updated policies.
- There should be easy access to educational resources such as articles, journals for staff members and time should be scheduled to read them.
- Staff should be motivated to develop their careers by studying further, taking part in research and gaining more skills and knowledge in the renal field.
- Articles on prevention of vascular access infection should be made available and discussed in the unit as an informal part of on-going education.
- Staff to be encouraged to advance their careers through research studies to gain more knowledge and skills in the Nephrology field.

5.6.2 Nursing Education

The following recommendations are made for nursing education:

- Students should be encouraged to conduct research in order to become familiar with current best practices. They should attend conferences, read articles and be part of journal clubs.
- Nephrology training should include prevention of vascular access infection, new and current information on evidence based practice.

- Professional development should be compulsory for nurses to motivate them to become active participants by attending congresses and lectures in order to enhance their knowledge levels.
- Nursing facilitation and lectures to incorporate evidence based measures to prevent vascular access infection daily in the renal dialysis units.

5.6.3 Nursing Research

The following recommendations are made for nursing research:

- The study should be repeated on a larger population and sample and be expanded to other hospitals in all the provinces in South Africa. This would help to enhance generalizability of the findings and development of national policies.
- Further research should be done to evaluate knowledge of nephrology nurses prior to and after an educational intervention on evidence based guidelines for prevention of vascular access infection, in order to identify knowledge gained after an educational intervention.
- A study should to be conducted nationally to evaluate protocols used on prevention of vascular access infection and adherence of hospitals to the guidelines.

This chapter concludes the research report. To expand on nephrology nurses knowledge of evidence based guidelines for the prevention of dialysis-catheter related infections in the renal dialysis unit's in-service education is required to use the data to improve nursing practice. This can be followed by an on-going audit of actual practice to use the data to improve nursing practice. This will assist in the development of a culture of EBP practice and improvement of patient outcomes.

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APPENDIX A

KNOWLEDGE OF NEPHROLOGY NURSES ON EVIDENCE-BASED GUIDELINES FOR PREVENTION OF DIALYSIS CATHETER RELATED INFECTIONS

PANEL OF EXPERTS INFORMATION LETTER

Dear Colleague,

My name is Mphanye Joseph Ntlhokoe. I am currently registered as a student at the University of the Witwatersrand, in the Department of Nursing Education for the degree of Master of Science in Nursing (Nephrology Nursing). I am hoping to conduct a research project to evaluate and describe Nephrology care nurses' knowledge of evidence-based guidelines for prevention of dialysis catheter related infections.

I hereby invite you, as an expert in the field of nephrology nursing as well as nursing education and clinical training, to be part of an expert group in assisting me to validate the data collection instrument. You will be asked to evaluate the instrument for content validity and appropriateness to the South African context using a **4-point Likert Scale**, **where 1 connotes not relevant; 2, unable to assess relevance without item revision or item is in need of such revision that it would no longer be relevant; 3, relevant but needs minor alteration and 4, very relevant and succinct** (Lynn 1986:384). Should you wish to make additional comments for all the items, an additional space is provided on the sheet.

Participation in the validation process is entirely voluntary. No identification of your personal information will be given when reporting your opinions so as to ensure anonymity and confidentiality. If you consent to be part of the expert group, please complete the attached consent form and return it to me in the stamped addressed envelope enclosed.

You will derive no benefit from participation in this study, however I hope the results of the study will provide valuable information regarding nephrology nurses' knowledge on current evidence based nursing practice and help direct nursing education and training as well as continuing development of Intensive Care nurses.

The research committees of the University of Witwatersrand, Gauteng Health Department and relevant health institutions have approved the study and its procedures.

Thank you for taking time reading this information letter. Please do not hesitate to contact me, should you require further information regarding the study, on the following number **078 627 6446 or email: mphanye@gmail.com**

Yours faithfully,

Mphanye Joseph Ntlhokoe
MSc Nursing Student

APPENDIX B

KNOWLEDGE OF NEPHROLOGY NURSES ON EVIDENCE-BASED GUIDELINES FOR PREVENTION OF DIALYSIS CATHETER RELATED INFECTIONS

PANEL OF EXPERTS CONSENT FORM

I _____ (name) give permission to be included in the study. I have read and understood the content of the information sheet and I have been given the opportunity to ask questions I might have regarding the procedure and my consent to being included in the study.

_____ _____

Date Signature

APPENDIX C

PANEL OF EXPERTS EVALUATION

Evaluation questionnaire concerning nephrology nurses' knowledge of interventions for prevention of dialysis catheter related infections	Rating Scale				Comments
	1	2	3	4	
This questionnaire is anonymous. Please do not write your name. **Please indicate the following:** Age: _____ Sex: Male ☐ Female ☐ Years working in Renal Dialysis unit : _____ Do you have a Degree or Diploma in Nephrology Nursing? _____ **Some of the internationally proposed strategies for preventing dialysis catheter related infections are listed below. Please mark which suggestions are recommended in the evidence based guidelines for prevention of dialysis catheter related infections.**					
1. During accessing vascular access hands should be washed a) Before accessing vascular access b) After accessing vascular access c) Before and after accessing vascular access d) I am not sure					
2. During accessing vascular access skin should					

be cleaned with a) >0.5% Chlorhexidine and 70% alcohol solution b) 10% Povidine Iodine c) Chlorhexidine gluconate 0.5% d) I am not sure					
3. What type of vascular access dressing should be used to dress the vascular access exit site a) Transparent dressing b) Gauze dressing c) Both d) I am not sure					
4. When should a vascular access dressing be removed a) When damp, soiled or loose b) On every dialysis appointment c) Both d) I am not sure					
5. What type of antibiotic/antiseptic ointment should be applied to the vascular site to help reduce infection a) Povidine-Iodine ointment b) Mupirocin ointment c) Both d) I am not sure					
6. What anticoagulation lock should be instilled into the patient's catheter lumens to help prevent clotting, thereby playing a role in preventing infection a) Low molecular Heparin b) Warfarin c) Both d) I am not sure					
7. All vascular catheter exit sites should be checked before each dialysis session and any signs of infection be reported immediately to the doctor a) Before each dialysis session b) After each dialysis session c) Both d) I am not sure					
8. Fistulas and Grafts should be checked for swelling and redness before each dialysis session a) Before each dialysis session b) After each dialysis session c) Both d) I am not sure					
9. Vascular catheter dressing should be changed a) Before the patient is connected to					

dialysis b) during connection to dialysis c) After dialysis session d) I am not sure					
10. What protective clothing should staff wear to minimise and help avoid contamination of the vascular catheter exit site through mouth and nasal flora a) Face masks b) Gloves and goggles c) Gloves, face masks and goggles d) I am not sure					
11. What advice should be given to patients to help avoid contamination of the vascular catheter exit site through mouth and nasal flora a) Minimise talking b) Look away from vascular access exit site c) Both d) I am not sure					
Do you think you are sufficiently informed about the prevention of dialysis catheter related infections in patients receiving dialysis treatments? Yes ☐ No ☐ If yes, by whom? _____					
Thank you for your collaboration.					

Rating Scale: 4-point Likert Scale, where 1 connotes not relevant; 2, unable to assess relevance without item revision or item is in need of such revision that it would no longer be relevant; 3, relevant but needs minor alteration; 4, very relevant and succinct

APPENDIX D

Evaluation questionnaire concerning nephrology nurses' knowledge of interventions for prevention of dialysis catheter related infections

The questionnaire is anonymous. Please do not write your name.

Please indicate the following:

Age: _____ Sex: Male ___ Female _____

Years working in Renal Dialysis Unit: _____

Do you have a degree or Diploma in Nephrology Nursing? _____

Some of the internationally proposed strategies for preventing dialysis catheter related infections are listed below: Please mark which recommendations are recommended in the evidence based guidelines for prevention of dialysis catheter related infections.

1. During accessing vascular access hands should be washed
   a) Before accessing vascular access
   b) After accessing vascular access
   c) Before and after accessing vascular access
   d) I am not sure

2. During accessing vascular access skin should be cleaned with
   a) 2% Chlorhexidine and 70% alcohol solution
   b) 10% Povidine iodine
   c) Clorhexidine gluconate 10%
   d) I am not sure

3. What type of vascular access dressing should be used to dress the vascular access exit site
   a) Transparent dressing
   b) Gauze dressing
   c) Both
   d) I am not sure

4. When should vascular access dressing be removed
   a) When damp, soiled or loose
   b) On every dialysis appointment
   c) Both
   d) I am not sure

5. What type of antibiotic/antiseptic ointment should be applied to vascular site to help reduce infection
   a) Povidine-iodine ointment
   b) Mupirocin ointment
   c) Both
   d) I am not sure

6. What anticoagulation lock should be instilled into the patients catheter lumens to help prevent clotting
   a) Low molecular heparin

b) Warfarin
c) Both
d) I am not sure

7. All vascular catheter exit sites should be checked before each dialysis session and any signs of infection be reported immediately to the doctors
   a) Before any dialysis session
   b) After each dialysis session
   c) Both
   d) I am not sure

8. Fistulas and Grafts should be checked for swelling and redness before each dialysis session
   a) Before each dialysis session
   b) After each dialysis session
   c) Both
   d) I am not sure

9. Vascular catheter dressing should be changed
   a) After the patient is connected to dialysis
   b) During connection to dialysis
   c) After dialysis session
   d) I am not sure

10. What protective clothing should staff wear face shields, to minimize and help avoid contamination of the vascular catheter exit site through mouth and nasal flora
    a) Face masks and gloves
    b) Gloves and goggles
    c) Gloves, face masks and goggles
    d) I am not sure

11. What advice should be to patient to help avoid contamination of the vascular catheter exit site through mouth and nasal flora
    a) Minimise talking
    b) Look away from vascular access exit site
    c) Both
    d) I am not sure

Do you think you are sufficiently informed about the prevention of dialysis catheter related infections in patients receiving dialysis treatments?

Yes _____ No _____

If yes by whom _____
_____
_____

Thank you for your collaboration

APPENDIX E

KNOWLEDGE OF NEPHROLOGY NURSES ON EVIDENCE-BASED GUIDELINES FOR PREVENTION OF DIALYSIS CATHETER RELATED INFECTIONS

PARTICIPANT CONSENT FORM

I _____ (name) give permission to be included in the study. I have read and understood the content of the information sheet and I have been given the opportunity to ask questions I might have regarding the procedure and my consent to being included in the study.

_____ _____

Date Signature

APPENDIX F

KNOWLEDGE OF NEPHROLOGY NURSES ON EVIDENCE-BASED GUIDELINES FOR PREVENTION OF DIALYSIS CATHETER RELATED INFECTIONS

PARTICIPANT INFORMATION LETTER

Dear Colleague,

My name is Mphanye Joseph Ntlhokoe. I am currently registered as a student at the University of the Witwatersrand, in the Department of Nursing Education for the degree of Master of Science in Nursing (Nephrology Nursing). I hope to conduct a research project and would therefore like to invite you to consent to being included in my sample of nephrology nurses.

The purpose of this study is to evaluate and describe nephrology nurses' knowledge on evidence based guidelines for prevention of dialysis catheter related infections and to highlight possible causes that prevent the implementation of such guidelines in order to make recommendations regarding nursing practice, education and further research.

Participation in the study is entirely voluntary. You may choose not to participate or to withdraw from the study at any time, without any penalties whatsoever. Anonymity and confidentiality will be ensured and your identification will not be disclosed or reported in the study. I appreciate you will derive no direct benefit from participating in the study; however I hope that the results of the study will provide valuable information regarding Intensive Care nurses' knowledge on current evidence based nursing practice and help direct nursing education and training as well as continuing development of nephrology nurses. Results of the study will be available to you should you so wish.

The appropriate people and research committees of the University of the Witwatersrand, Gauteng Department of Health and this healthcare institution have approved the study and its procedures.

Thank you for taking time to read this information letter. Should you require any further information regarding the study or your rights as a study participant, please contact me in the Department of Nursing Education or on the following telephone number: **078 627 6446 or by email: mphanye@gmail.com.**

APPENDIX G

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130921

NAME: (Principal Investigator)	Mr Mphanye Joseph Ntlhokoe
DEPARTMENT:	Nursing Education Charlotte Maxeke Johannesburg Academic
PROJECT TITLE:	Knowledge of Nephrology Nurses on Evidence-Based Guidelines for Prevention of Dialysis Catheter Related Infections
DATE CONSIDERED:	27/09/2013
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Shelley Schmollgruber
APPROVED BY:	Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 27/09/2013

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**.

Principal Investigator Signature M130921Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX H

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Enquiries:
Ms. L. Mngomezulu
Tell: (011): 488-3793
Fax: (011): 488-3753
03rd December 2013

Mr. MJ Ntlhokoe
MSc Nursing student
University of the Witwatersrand

Dear Mr. Nlhokoe

RE: "Knowledge of nephrology nurses on evidence-based guidelines for prevention of dialysis catheter related infections"

Permission is granted for you to conduct the above research as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Approved / ~~not approved~~

Ms. M.M. Pule
Acting Chief Executive Officer

APPENDIX I

LANGUAGE EDITING AND PROOFING

Gill Smithies

Proofreading & Language Editing Services

59, Lewis Drive, Amanzimtoti, 4126, Kwazulu Natal

Cell: 071 352 5410 E-mail: moramist@vodamail.co.za

Work Certificate

To	Mphanye Joseph Ntlhokoe
Address	Wits Dept of Nursing Education
Date	18/9/2014
Subject	Thesis: Foreward and Chapters 1 – 5 KNOWLEDGE OF NEPHROLOGY NURSES ON EVIDENCE BASED GUIDELINES FOR PREVENTION OF DIALYSIS CATHETER RELATED INFECTIONS, by Mphanye Joseph Ntlhokoe.
Ref	SS/GS/04

I, Gill Smithies, certify that I have proofed and language edited:

Thesis: Foreward and Chapters 1 – 5 by Mphanye Joseph Ntlhokoe,

KNOWLEDGE OF NEPHROLOGY NURSES ON EVIDENCE BASED GUIDELINES FOR PREVENTION OF DIALYSIS CATHETER RELATED INFECTIONS,

to the standard as required by Wits Dept. of Nursing Education.

Gill Smithies

18/9/2014