EVALUATION OF NURSES' COMPETENCE IN THE PREVENTION OF PERIPHERAL VENOUS CANNULAE RELATED INFECTIONS AT SUB COUNTY HOSPITALS, ELDORET

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science in Advanced Nursing Practice (Medical Surgical) of Masinde Muliro University of Science and Technology

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DEDICATION

This research is dedicated to my husband Gilbert Kipkemboi Ngetich, my daughter Harmony, my mother Gatwiri, my mother in law Evalyne, my late dad Riungu, my brother Mwenda, and my sister Kawira, who were ever by my side. Miriam Kainda and Purity Mukami, for holding my hand when I needed a friend to talk to.

ABSTRACT

Background: Peripheral intravascular cannulae, is a device that is used in hospital inpatient for patient management. The device is linked to complications such as infections, which harm patient health,satisfaction and increase healthcare costs.

Objective: This study was aimed at evaluating the competence of nurses in preventing cannula-related infections in newly upgraded sub-county hospitals.

Methodology: Analytical cross-sectional design was used in four sub-county facilities, and applied quantitative and qualitative approach which described and analyzed the knowledge and skills of 86 nurses. Census was applied. There was direct observation which determined whether the nurses in the four facilities applied their theoretical knowledge and skills in practice. A structured questionnaire and observational checklist were used.

Results: Most nurses (87%) had adequate knowledge, who correctly responded to ≥50% of the 10 knowledge items. Using the observation checklist, highest awareness was observed in areas such as skin preparation before cannula insertion (100%), wearing non-sterile gloves and adhering to aseptic technique (97.7%). However, only 36.1% correctly knew the recommended time for cannula removal (12–72 hours), which showed a significant knowledge gap. Logistic regression further revealed that nurses with ≥10 years of experience were 1.53 times more likely to be competent (OR = 1.53; 95% CI: 1.36–1.72; $p < 0.001$), and those with 5–9 years had 1.22 times greater odds (OR = 1.22; 95% CI: 1.17–1.81; $p = 0.050$) compared to nurses with <5 years of experience. The knoweldge and observed skill was used to determine the competency of nurses which was at 66.7% in nurses who scored >50% in both knowledge and application.

Conclusion: The study concluded that most nurses (87%) demonstrated adequate knowledge in infection prevention practices which includes skin preparation and aseptic technique. There were gaps in specific areas of knowledge of the recommended cannula dwell time. There were few nurses who had a gap in their skills. Nursing experience was significantly associated with higher competence, underscoring the importance of continuous training and mentorship to bridge identified gaps.

Recommendation: The study recommends enhancing nurses' clinical competence and knowledge in IV cannulation through improved training, regular audits, and interdisciplinary collaboration. It also highlights the need to bridge the gap between theory and practice to ensure effective infection prevention in the insertion, removal, and care of intravenous cannulae.

Key words: Peripheral intravenous cannula, Infection, prevention, Nurses' competence

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LIST OF ABBREVIATIONS AND ACRONYMS

CDC	Centers for Disease Control and Prevention
CRBSI	Catheter-related Bloodstream Infection
HICPAC	Healthcare Infection Control Practices Advisory Committe
IREC	Institutional Research and Ethics Committee
PIC	Peripheral Intravascular Cannula
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization.

OPERATIONALIZATION OF KEY TERMS

Aseptic Technique: Practices and procedures used to reduce risk of infection by preventing the introduction harmful microorganisms from hands, surfaces, or equipment to a sterile injection site. It involves the use of a sterile field and sterile equipment, and ensuring equipment remain sterile is not contaminated (Smith, 2014).

Competency of Nurses: An ability of executing certain tasks applying appropriate knowledge (Mrayyan, et al., 2023).

Demographic Factors: Factors such as age, gender, level of education and years of experience are essential for interpreting research findings and ensuring representative sampling (Creswell & Creswell, 2018).

Infection Control Guidelines: Developed procedures and best practices providing a structured approach to minimizing the transmission of hospital acquired infectious agents in healthcare environments (Centers for Disease Control and Prevention, 2025).

Intravascular Cannula: A flexible tube that is inserted into a vein and used to draw blood, administer medication, or deliver fluids (Open Resource for Nursing, 2023).

Intravascular-Related Cannula Infections: Bacteria entering the bloodstream through the cannula which happen at the site of insertion or within the bloodstream (Mermel, 2017).

Preventive measures: Techniques and protocols used to stop infections from happening, such as aseptic methods, hand washing, suitable cannula selection, prompt cannula removal, and appropriate site care (Mermel, 2017).

Knowledge: Awareness and comprehension of a body of information and the ways in which it can be applied to support a particular task or decision-making process (McGonigle & Mastrian, 2024). Particular domains of knowledge that nurses need to be aware of, like knowing when to remove a cannula, how important skin preparation is, and how to use aseptic technique.

Observed Practice: Direct clinical observation enables evaluators to assess healthcare workers' performance and adherence to standards by observing their actions in real-world settings (Office of

Program Consultation and Accreditation, 2018).

Perceived Competence: Reflects nurses' self-assurance in their ability to implement infection control measures effectively, often measured through attitude-based assessments (Deci & Ryan, 2000).

CHAPTER ONE INTRODUCTION

1.1 Overview

This chapter discussed was the study background, causes of Peripheral Intravascular Cannulae (PIC) related infections and factors associated with PIC related infections. It also discusses the statement of the problem, the objectives, the justification for the study and conceptual framework.

1.2. Background of the Study

Peripheral intravenous (IV) catheterizationis a task that is carried out by the nurses in healthcare facilities and offer access for the nurses to administer medications,blood components, nutritional supplements and intravascular fluids (Welyczko, 2020). Globally, there are more than 60% of all patients being managed as inpatients that have to have a PIC in place when they get admitted (Rodriguez-Calero et al., 2020). It is a standard procedure which if done incorrectly, maintained inappropriately or during removal it can lead to severe complications such as (Lacostena-Pérez et al., 2019).

Peripheral intravascular cannula (PIC)-related infections contribute to morbidity and healthcare-associated infections (HAIs). In previously done researches, Staphylococcus aureus, coagulase-negative staphylococci, and Candida species are pathogens linked to these infections (Osório et al., 2023). Incidence globally of PIC-related infections range from 2% to 80%, which depend oncharacteristics of patients, the insertion technique, and protocols (Hawthorn et al., 2019). Prevalence rate of PIC-related infection is 31% of patients receiving PIC treatment and supplements. 4% of phlebitis is diagnosed in all patients who get PIC inserted (Lv & Zhang, 2020).

Nurses are taught in training school to practice aseptic methods, hand hygiene protocols, and correct cannula removal as primary strategies for infection prevention. The likelihood of experiencing complications is depends on patient comorbidities, duration of cannula placement, type and size of the cannula used, and adherence to infection prevention standards (Osti et al., 2019). Competence in peripheral intravenous cannulation (PIC) processes integrates academic knowledge with clinical

skills. The nurse with IPC knowlegde, aseptic methods, documentation requirements, and clinical skills ensures the safe and accurate implementation of the PIC procedure (Gašpert, 2025). The combination of these knowledge and skills enable nurses to perform PIC insertion, care, and maintenance effectively, minimizing complications like phlebitis and bloodstream infections. Additionally, a proficient nurse applies evidence-based guidelines applying attained knowledge through skilled practice, which enhances patient safety and care quality (Timsina, 2024). Effective competence focuses on decision-making capacity, professional standard compliance, and infection control protocol adherence.

In Kenya, infection prevention and control (IPC) knowledge among healthcare professionals is inadequate, which shows gaps in compliance with aseptic procedures, hand hygiene practices, and documentation (Kouko, 2023). When there is inadequate supervision there is low chances for sustained professional growth, and heavy patient burdens which causes low quality of care (Rezaee et al.). These barriers increase the likelihood of PIC-related infections, which prolongs hospitalization, increase cost, and worsen patient outcomes. Global studies have addressed the prevalence and risk factors for PIC-related infections. However few have investigated nurses' competencies based on knowledge and observed skills in preventing these infections within Kenyan contexts. Getting to understand these competencies builds focused approaches, enhances nursing preparation, and improves patient safety measures.

1.3. Statement of Problem

Peripheral intravenous cannulation (PIC) is a nursing procedures performed in hospital. It is a routine practice that leads to complications such as phlebitis, infiltration, and bloodstream infections which are frequent and preventable (Zingg et al., 2023). Research shows up to 60% of hospitalized patients have a PIC at any given time, yet several develop PIC - related infections due to poor aseptic technique and incorrect maintenance (Rodriguez-Calero et al., 2020). PIC -related infection remain a concern in both public and private healthcare facilities. Research have highlighted challenges in nurses’ compliance with infection control protocols, poor documentation of cannula insertions, and

inconsistent use of aseptic procedures during insertion and ongoing care (Osti et al., 2019). These challenges not only increase the risk of infection but also contributes to long stays in hospital, increased healthcare costs, and reduced patient safety.

In Uasin Gishu County, sub-county Kesses, Burnt Forest, Turbo, and Ziwa hospitals' nurses perform PIC in medical and surgical units. Each facility's bed capacity is 40, with patients hospital stay being between 5 to 7 days. County records from the medical superintendent's office (2018) show approximately 2,080 patients get admitted ad one routine in admission is insertion of PICs.

Despite there being infection prevention guidelines, audits and anecdotal evidence, there is a gap between nurses' knowledge and actual clinical practice in PIC insertion, care, and removal. The effectiveness of these protocols largely depends on the individual nurse's competence. However, few studies have assessed nurses' knowledge and practical skills in preventing cannula-related infections in this region. In fact, no research has been conducted in Uasin Gishu on nurses' competence in managing peripheral intravenous cannulas. Evaluating these competencies is essential for designing targeted interventions, enhancing infection control efforts, and improving patient safety in Uasin Gishu and similar healthcare environments.

1.4 Objectives

1.4.1 Main Objective

The objective was to evaluate Nurses' Competence the on prevention of peripheral intravenous cannulae –related infections

1.4.2. Specific Objectives

i. To assess nurses' knowledge on preventive interventions for PIC–related infections
ii. To determine the nurses' skill on prevention of PIC–related infections
iii. To analyze the level of nurses' competence on preventive interventions for PIC–related infections.

1.5. Research Questions

i. What is the nurses' level of knowledge on preventive interventions for on prevention of P I C – related infections?

ii. What are the nurses' level of skill on prevention of P I C –related infections?

iii. What is the nurses' level of clinical competence of nurses on prevention of P I C –related infections?

1.6. Justification of Study

Intravascular tubes serve an important function in supplying medicines, liquids, and blood derivatives to patients, though their implementation carries an increased danger of problems, especially septic conditions. 27% to 70% of patients undergoing intravenous therapy develop phlebitis, which involves inflammation of the vein wall (Bai, 2022)). The Infusion Nurses Society states that phlebitis rates should stay under 5% for all patient populations (Kassahun et al., 2022)). Extravasation, the leakage of IV fluids into adjacent tissues, is another common problem that happens in 0.1% to 6% of cases (Kim et al., 2020)).

Statistics show PIC-related infections have adverse adverse events and make conclusions that effective protective strategies and skilled nursing interventions reduce poor patient outcomes. In Kenya, Kenya Health Policy 2012–2030 identifies Infection Prevention and Control (IPC) a pillar of quality healthcare and patient safety. It aims to reduce healthcare-associated infections (Ministry of Health, Kenya, 2014). There is an emphasis to integrate IPC in all levels of healthcare provision by Kenya National IPC Strategic Plan for Health Care Services 2021–2025. This contributes to achievement of Universal Health Coverage (UHC) (Ministry of Health, Kenya, 2021). In order to attaining the national health targets, there is a need for nurses to be competent.

Globally, IPC is fundamental in patient safety, antimicrobial resistance (AMR) prevention, and quality healthcare (World Health Organization, 2023). Nurses' IPC capabilities aligns with African Union's Agenda 2063. It contributes to achieving a healthy and productive population through resilient health systems (African Union, 2015)). Additionally, Africa Centres for Disease Control and

Prevention (Africa CDC) states there is a need for healthcare worker training to strengthen IPC in member states (Africa CDC, 2020). Researches support local and global health programs that seek to advance better patient outcomes through identification of challenges in clinical practice. This research provides a crucial understanding of nursing competency so as to avoid PIC-related infections, a primary contributor to healthcare-associated infections. Despite the existing training programs and guidelines, there is limited data on nurses' skills in clinical field in Kenyan hospitals. Through evaluation of nurses' knowledge and skills, the research seeks to analyze the competence in prevention of PIC - related infections.

1.7 Limitations

Design: The cross sectional study lacked causality since it was a single-point data collection.

Sampling technique: Systematic random sampling has hidden patterns in the population from different healthcare facilities; selection bias, assumption of homogeneity. These could introduce bias as well as not adequately captured in different facilities.

Sample size: The small sample size of 86 patients had a limited statistical power, generalization, and bias. This is because it may not adequately represent a broader population in larger healthcare facilities with different resource availability. These limitation was addressed by ensuring census. Multicenter studies across multiple healthcare settings were carried out to increase sample size and diversity.

1.8 Significance of Study

This research underscored the importance of knowledge while applying skills in PIC care as well as the need to bridge the gap between the knowledge and clinical skills as well as continuous nursing education in healthcare settings. The study identified the existing gap in the two variables as well as the differences between their self assessment and actual practice. Sustained education efforts will see to it that the nurses apply the knowledge acquired in their training to their clinical practice.

The research emphasizes on establishing knowledge and practice standards across all nursing categories. It also provides information that will be valuable to training institutions, the healthcare

institutions and IPC departments which have a responsibility to enhance patient safety, reduce cannula associated infections and increase healthcare standards.

1.9. Scope of the Study

The study covered a scope on assessing nurses' competence in preventing PIC-related infections in recently upgraded sub county hospitals in Uasin Gishu. The nurses working in those sub county hospitals were selected to participate in the study. There was a direct observation checklist that were applied for the nurses during their routine nursing procedure of PIC. There was also self assessment and knowledge data collection tool to assess the nurses' adherence to IPC guidelines. Ethical guidelines were followed, getting informed consent, voluntary participation by the nurses, observation of confidentiality and protection of human participants during the study. Relevant approvals were sought from institutional review board and ethics committees.

1.10 Purpose of Study

The study purposed to asses the knowledge and clinical skills of qualified nurses onprevention of PIC- related infections, in an aim to evaluate their clinical competence. It also analyzed the relationship between selected demographic factors and nurses knowledge and competence on prevention of PIC- related infections.

1.11. Conceptual framework

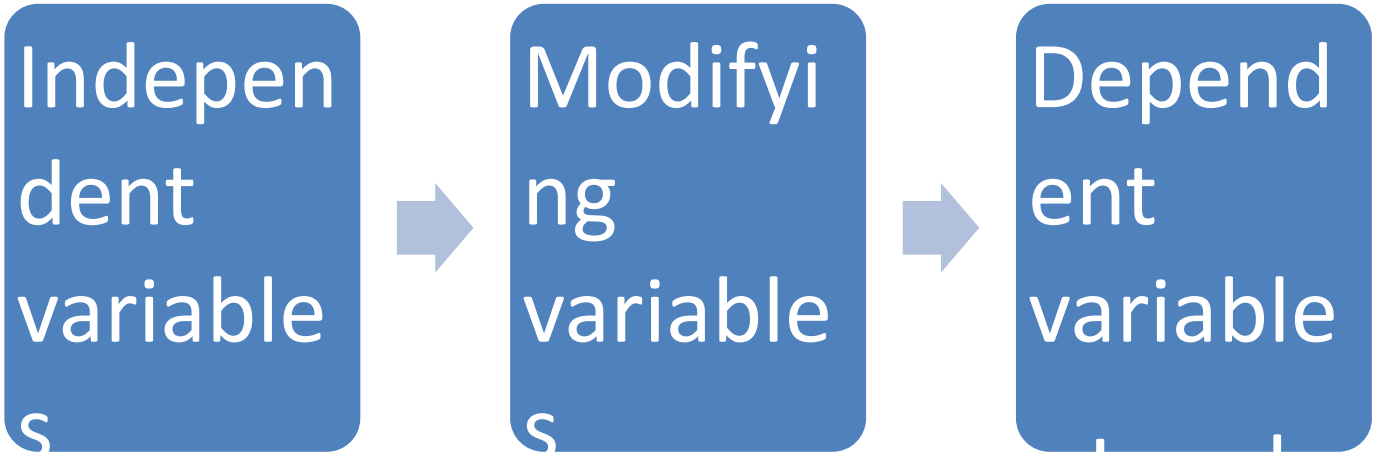

Figure 1: Conceptual Framework (Mrayyan, 2023)

Nurse competence on prevention of PIC- related infections is assessed by meeting minimum requirements in knowledge and clinical skills by the nurses in sub county healthcare facilities. As stated by Nyangena et al., in order for the nurses to qualify they have to get at least 50% points on knowledge and 50% on clinical practice so as to be said to be competent (2013).

Knowledge: It is the nurses understanding of the theoretical scientific approaches in prevention of PIC -related infections. It includes understanding the appropriate site preparation methods, appropriate use of disinfectants, selecting the right cannula size, observing dwell duration, and identifying possible complications.

Clinical skills illustrates practice of nurses in PIC process which encompass IPC fundamentals such as hand hygiene protocols, aseptic technique, dressing application and accurate documentation. A 61-item observation checklist was used on assessing correct performance of the procedure.

Demographic factors were moderators that influences the nurses professional competence. It included the level of education, years of experience and department the nurses were working on; whether surgical or medical unit.

Primarily the research focused on the process related indicators on effective application of existing guidelines in PIC care. From the variables relationships, the nurses knowledge, clinical skill and self assessment contributed to their said to be competently performing the PIC procedure. Competence is defined by the combined achievement of theoretical knowledge and practical skill (Timsina, 2024). When nurses score well on knowledge and clinical practice, there are expected lower patients PIC - related infections and better patient outcomes.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter reviewed the epidemiology of the intravascular cannulae-related infection and the literature on preventive measures for peripheral intravascular cannulae-related infection. This is on care and maintenance of peripheral intravascular cannulae-related infections. It also reviewed literature on training of the nurses on prevention of peripheral intravenous cannulae –related infections. Secondly, it reviewed literature on clinical competence of nurses in inserting, removing, and caring for peripheral intravenous cannulae. Finally, it reviewed the literature of the existing relationship between nurses' selected demographic data and competence on prevention of intravenous cannulae -related infections.

2.2 Background on Peripheral Intravascular Cannulae Infection

It is improtant to understand the risks for PIC -related infections so as to imporve patient outcomes and practice in healthcare. Welyczko (2020) discusses the risks and complications of PIC and recommending the use of local anesthetics prevention, and clinical management of PIC related complications.

2.2.1 Nature and Usage of Peripheral Intravascular Cannulae

Peripheral intravascular cannula is a short tem plastic device that is inserted on human body by puncturing using a needle,especially on the forearm or hand. It is used to administer medications and other therapeutic components into the bloodstream (Open Resource for Nursing, 2023). An infusion pump can be used on the PIC for precise and controlled administration for the sick patients (Elli *et al.,* 2020).

2.2.2 Clinical Impact of Cannulae-Related Infections

The PIC - related infections have severe clinical outcomes. In one study, 57 patients admitted in the intensive care unit had PIC related infections during their inpatient days. The PIC -related infections contributed to increased mortality, prolonged hospital stay and increased costs (Martínez-Martínez *et*

al., 2022).

2.2.3 Epidemiology

In hospitalized patients, the incidence of phlebitis ranges from 13% to 56%, marked by symptoms such as pain, erythema, edema, a palpable venous cord, and purulent discharge at the catheter site. Phlebitis can lead to more severe complications like cannula-related bloodstream infections (CRBSI) (Lulie et al., 2021).

Cannula-related bloodstream infections impacts the management of patients in the ward and the cost of healthcare hence they should be prevented through appropriate interventions. Early detenction is important in order to get timely treatment for the patients diagnosed. They are also associated with morbidity and mortality as discussed by Greene (2022). These infections not only cause localized discomfort for the patient but also result in prolonged hospital stays and increased medical expenses (Lulie *et al.,* 2021).

2.3 Nurses' Knowledge on Preventive Interventions for Peripheral Intravenous Cannulae –Related Infections

The nurses are required to be trained on the preparation, drug administration and managing the intravenous cannulae. All the nurses should be aware of the infection prevention control protocols that are implemented to reduce the risk for intravenous cannulae-related infections (Behairy *et al.,* 2023). Hence it is a requirement for the nurses to have certain knowledge on care and maintenance of cannulae. The knowledge of all the nurses should be assessed as to how they insert and manage intravenous cannulae for therapy. The nurses should be educated and trained on intravenous cannulae care and maintenance so that they get equipped with necessary skills so that they can identify any developing problems and intervene to prevent them from taking place. These programs would equip the nursing staff with theoretical and practical skills so that they can be up-to-date skills to apply in their nursing practice. Guidelines for preventing intravascular cannulae infections have been updated by the Healthcare Infection Control Practices Advisory Committee (HICPAC) and the Centers for Disease Control and Prevention (CDC) (Greene, 2022).

The nurses should have knowledge on the indications of intravenous cannulae use, the procedure that should be followed when inserting and maintaining intravenous cannulae, hand hygiene, application of aseptic technique when inserting intravenous cannulae and the infection prevention measures that can be applied to prevent development of intravenous cannulae-related infections. Such knowledge should be on the environment preparation, hand hygiene, observation of aseptic technique, and skin preparation.

2.3.1 Hand Hygiene

In a study performed at Moi Teaching and Referral Hospital, Kenya, 52.4% of the 553 observed encounters were made by nurses. The most common technique was the insertion of an intravenous cannula (11.2%), which was followed by newborn assessment (10.7%) and drug administration (10.5%). Low risk procedures made up about 69% of the procedures, whereas high risk procedures made up 31%. The majority of the procedures were carried out in shifts during the day. Statistics show a correlation between poor hand hygiene practices and the risk of infection in young, ill babies. This risk was increased by 2 times when the procedures were performed by nurses (pv=0.001, 95% CI =1-2.9) and by 6 times when the procedures were performed by registrars (pv=0.008, 95% CI =1.6-23). Even after controlling for confounding factors, newborn inspection was statistically linked to a lower risk of infection (pv=0.001, odd ratio=0.0. It illustrates the importance of having hand hygiene practices being upheld to prevent hospital acquired infection being transmitted to vulnerable patients (Irene et al., 2022).

2.3.2 Aseptic Technique

Improvements in pre-registration nursing education, continuous nursing education, increased access to clinical information, and comprehensive guidelines are all necessary for procedures that require aseptic technique. The production of guidelines should use a recognized approach in order to fulfill modern requirements. Before having interaction with actual patients, student nurses should be taught the knowledge and abilities needed to carry out and modify those procedures according to scenario (Gould. 2023). It has been advised that all medical professionals who administer IV therapy must

base their treatment decisions on the most up-to-date research and best practices. Additionally, each practitioner must uphold rigorous. IV practice standards and follow aseptic procedures, manual hygiene, and its applications to maintain their knowledge and skills in a safe and efficient manner throughout their careers (Maharjan *et al.,* 2020).

2.3.3 Skin preparation

This is where the skin is done using a particular technique with an appropriate solution and then it is left to dry. This is a technique that ensures the microbial contamination is prevented. In a study done by Osti *et al.,* (2019), 93% of respondents were aware that skin preparation at the insertion site is necessary prior to inserting an IV cannula. When preparing, inserting, and removing IV cannulas, 95% of respondents (99.5%) consistently used aseptic technique, and each and every one of them was aware of the factors influencing the risk of infection. Just over 94.5 percent of those surveyed knew how important it is to take care of their skin before surgery.

According to Ray-Barruel' and Alexander (2023) systematic review, there are bundles of care that aim to condense extensive recommendations into a brief point- of-care reminder to increase staff adherence to best practices; as a result, bundle components should be supported by high quality evidence. In these bundles, skin preparation for intravenous cannula insertion is included.

2.4 Nurses' Skill on the Prevention of Peripheral Intravenous Cannulae – Related Infections

The cannulae-related infections usually occur around the skin surrounding the cannulae as well as the bloodstream (Marsh *et al.,* 2021). There are precautions and infection control measures that should be followed while one is carrying out this clinical procedure. There are also other measures that need to be considered while preparing and administering medications intravenously to critically sick patients (Open Nursing Resource, 2023).

The infection prevention control and procedure of inserting and removing as well as caring for the peripheral intravascular cannulae has been well illustrated in the nursing procedure manual that is used in training of nurse across the country. It has been approved by the nursing council of Kenya and it has all the steps a nurse should take while preventing the infection of intravascular cannulae.

Maharjan *et al.,* (2020) states that nurses who are taking care of patients in hospital settings should apply best practice while inserting and maintaining peripheral intravascular cannulae. They also need to maintain high level of knowledge and competent skills so as to enhance patient safety.

A study done by Osti *et al.,* (2021) evaluates the nurses at CMCTH in Bharatpur, Nepal, in terms of their knowledge and behaviors related to maintaining and caring for PIC. This study shows that the majority of nurses are proficient in IV cannula protocols and correctly apply them. Nurses may find it challenging to adhere to evidence-based recommendations for lowering IV catheter-related infections if they lack knowledge of appropriate nursing care and infection control. Despite the known dangers of PICs, some nurses still insert, remove, and maintain IV cannulas improperly and in violation of established protocol.

In a study done at Kakamega Kenya 30% of the nurses had previously taken continuing education in peripheral intravenous treatment, and only 3.3% were very knowledgeable. Following the introduction of the nursing care protocol, there was a noticeable improvement in knowledge and practice. The pre-test knowledge results were related to previous attendance in continuing nursing education. The results of the study show benefits of developing protocols as well as better nursing knowledge and skills, which inevitably improve patient health status and the hospital's quality rating (Joseph *et al.,* nd).

2.4.1 Environment

The need of maintaining a clean environment around the patient is highlighted by the presence of bacteria on the fingertips that have a high capacity to live in the environment, such as Acinetobacter, Enterococci, and Bacillus cereus. In no way do we support routine microbiological research on HCWs' contaminated fingers. However, we believe that the results from this particular study can be used in training sessions as they clearly demonstrate how HCWs' fingertips might become contaminated when hand hygiene procedures are not followed to the letter.

Farizon *et al.,* (2023), created an educational tool specifically designed to help health care providers performing peripheral intravascular cannulae insertions understand the importance of adhering to the

hand hygiene and glove usage recommendations using brief videos showing nurses failing to carry out hand hygiene during peripheral intravascular cannulae placement procedures, along with the results of the assessment of hand hygiene practices and the microbiological data obtained in the initial phase of the study.

2.4.2 Hand Hygiene

A risk assessment should be carried out to determine hand hygiene method and the solution that is used and whether it was appropriate for use. The topically applied preparation of >0.5% chlorhexidine solution with 70% alcohol or 2% water-based chlorhexidine, proper hand washing, and wearing clean gloves when handling connections and equipment are some of the strongest arguments in favor of asepsis in the prevention of phlebitis.

Actions that promote intravenous therapy's efficacy and safety include preserving venous access, managing infusion volume, monitoring patients continuously, looking for signs of phlebitis while saline solution and medication are being administered, and screening for symptoms (Guanche-Sicilia *et al.,* 2021).

When offering nursing care and carrying out nursing procedures, they should avoid wearing long sleeved clothes, keeping long nails and wearing wristwatches or stoned rings which would contribute to hand contamination (Marais, 2021).

2.4.3 Aseptic Technique

A risk assessment is expected to be carried out before cannulation so that the key parts and sites can be protected. An aseptic technique should be maintained when using the intravenous cannulae so that the risk for infection is reduced. This includes Utilizing the aseptic field (0% to 100%), capping ports (0% to 100%), and reducing contamination of essential components (80% to 0%). According to a study by Shettigar et al., (2021), there were notable increases in compliance with intravenous port scrubbing (0% to 72%).

An aseptic non-technique standard operating procedure for managing intravenous lines might be established and kept up for nine months. According to the qualitative study, the degree of illness was

a primary indicator of being compliant to the hub cleaning (Shettigar *et al.,* 2021).

2.5 The Relationship Between Nurses' Selected Demographic Data and Observed Practice on Prevention of Intravenous Cannulae -Related Infections

In a study done by Khairunniza *et al.,* (2019), there was no statistical significance between respondents' knowledge of PIC and sociodemographic factors. The results shows students in the study had high level of knowledge on PIC, as they scored 80 to 89%, The study's findings showed that it is important to take steps to reduce the danger that patients face.

Levels of education were linked to an increased sensitivity while fixing PIC so as to lower chances of PIC - related infections (Odonkor et al., 2020). In order to understand and apply the best practices in preventing infections, there is a need for the nurses to be well prepared through training which is thought those with higher level of education are more prepared. Expanded skills and knowledge are though to reduce the risk for PIC -related infections since they tend to adhere to available protocols and also in patient education on their role in infection control and sustaining their safety while in the hospital.

Despite the importance of knowledge and skills on prevention of PIC -related infection, there is limited studies on PICs. It is important to know how demographic factors related to the level of knowledge or competency.

2.6 Literature Gaps

There is a need to justify the reason to carry out this study in view of the existing literature.

2.6.1 Limited focus on nurse competence as a combined construct of knowledge and skill

There are several studies that evaluate the nurses' knowledge or actual practice in IPC and PIC -related infections. However, there are few that have analyzed the nurses competence which is a combination of knowledge and actual clinical practice. .

2.6.2 Insufficient evidence from Kenyan and regional contexts

There are several studies that have been conducted in developed countries but limited studies from Kenya and sub-Saharan Africa analyzing the competence of nurses in prevention of PIC -related

infections. This causes limited contextual applicability from global perspective to local healthcare facilities.

2.6.3 Weak linkage between demographic characteristics and competence

Few studies explore nurses' demographic factors such as education level, years of experience, and work area affect their knowledge, skills, and competence in infection prevention. However,they provide inconsistent results leading to incomprehensible statistical association.

2.6.4 Scarcity of observational assessments of clinical practice

Many studies rely self-reported data through questionnaires, which might not reflect their actual clinical practice. There is limited objective observation assessing whether nurses theoretical knowledge is translated into actual practice.

2.6.5 Inadequate evaluation of adherence to national and institutional IPC guidelines

Although policies such as the Kenya National Infection Prevention and Control Strategic Plan (2021–2025) emphasize safe practices, few studies have assessed how well nurses adhere to these standards, particularly regarding peripheral cannula management.

CHAPTER THREE RESEARCH METHODOLOGY

3.1 Overview

This chapter included the research methodology of the study. It described the research strategy, methodology, and approach as well as the data collection steps, sample selection process, data analysis process, and ethical considerations. This chapter contained an outline of the inclusion and exclusion criteria.

3.2 Study Design

The study design was analytical cross-sectional study design. The data was collected at a specific point in time and then was analyzed as a representative subset of population. It was then used to describe the knowledge, the clinical competence of the population and the relationship between the selected demographic data and the clinical competence of the population. The study therefore aimed at the objective of describing the practices of the nurses that prevent the intravascular cannulae related infections.

This is a research applied both the quantitative and qualitative approaches. The quantitative approach described and analyzed the research subjects in relation to their knowledge on preventing the intravascular cannulae related infections. The qualitative approach applied direct observation to identify whether the research subjects applied the knowledge of theory and skills in their clinical practice to prevent the intravascular cannulae related infections. To minimize the risk of observation bias (Hawthorne effect), facility in-charges were informed about the study for administrative clearance, but individual staff members were not notified of the specific observation schedule. This ensured that observations were unannounced, thereby reducing the likelihood that nurses would alter their usual practices in response to being observed.

3.3 Study Area

The Four sub-county hospitals: Kesses, Burnt Forest, Turbo, and Ziwa were study sites in Uasin Gishu County, which had just undergone an upgrade from health cente. The study was conducted in four recently upgraded sub-county hospitals: Kesses, Burnt Forest, Turbo, and Ziwa in Uasin Gishu

County, Kenya. Located in semi-urban and rural settings, these facilities operate under the Ministry of Health through the County Department of Health and serve predominantly rural and peri-urban populations. They provide outpatient, maternal and child health, immunization, minor surgical, laboratory, inpatient medical and surgical services, and emergency stabilization before referral to level 5 and 6 facilities. Patient flow is highest in outpatient departments, with moderate inpatient caseloads. Services are subsidized through the public health system and Social Health Authority with no user fees. Although infrastructure has been improved to meet sub-county hospital standards, the hospitals remain modest, with limited resources and staffing compared to larger referral facilities. Census was applied for all recently upgraded health centers that had been elevated to sub-county hospital status. A census of all four newly upgraded sub-county hospitals was applied instead of sampling to minimize selection bias by including all facilities with similar upgrade status, rather than selectively sampling a few. Given the small number of eligible hospitals, it was feasible to include the entire population, thereby improving representativeness.

3.4 Target Population

The study targeted all nurses working in four newly upgraded sub-county hospitals within Uasin Gishu County, Kenya. The total number of eligible nurses across these facilities was relatively small (N = 88).

3.5 Study Population

The study population was nurses working in the four facilities. They were selected using systematic random sampling where the selection took place from every facility. A list of the nurses in the facility was obtained and the names selected randomly after selection of one starting point.

3.6 Inclusion and Exclusion Criteria

3.6.1 Inclusion

- Nurses who had worked for at least 6 months in the study area.
- A nurse with a valid practicing license from nursing council of Kenya

3.6.2 Exclusion

- A nurse who declined consent.

3.7 Sampling Technique

Sampling frame

The study population comprised all registered nurses working in the selected sub-county hospitals in Uasin Gishu County. Four sub-county hospitals (Turbo, Ziwa, Kesses and Burnt Forest) were purposively selected from the six sub-county hospitals in the county because they had been recently upgraded and were relevant to the study context. The total number of nurses employed across these four facilities and included in the sampling frame was 88 (Turbo = 25; Ziwa = 20; Kesses = 22; Burnt Forest = 21). A staff register in the medical supretendant office (2018) from served as the sampling frame.

Sampling design

A proportionate stratified random sampling technique was used to ensure representation of nurses from each facility (stratum). Each selected hospital constituted a stratum. Proportionate stratification was chosen to preserve the relative size of each facility within the overall sample and to improve precision of estimates by ensuring all facilities were represented according to their workforce size.

Sampling procedure

Purposive selection of facilities (first stage): Turbo, Ziwa, Kesses and Burnt Forest sub-county hospitals were purposively selected from the list of six sub-county hospitals in Uasin Gishu because they were upgraded and met the study inclusion criteria.

Construction of sampling frame (second stage): The most recent nursing staff list (roster) for each selected facility was obtained from the county medical supretendant office. Each nurse on the list was assigned a unique identification number.

Allocation of sample to strata: Because the study population was relatively small (N = 88), the study aimed to achieve a census of all eligible nurses where n = 88 and $n_i = N_i$ for each facility.

Rationale

Proportionate stratified random sampling preserves representativeness across facilities of differing sizes and improves the precision of estimates for facility-level comparisons. Given the relatively

small overall population (N = 88), a census of all eligible nurses was considered the preferred option to maximize power and reduce sampling error.

3.8 Data Collection Procedures

After seeking approvals from relevant offices and authorities, a meeting was held in every facility and information concerning what the study was about was given. After every participant gave their informed consent, Data collection involved a multi-step process. The language of the data collection tools was English.

Tool 1: Demographic Questionnaire

The demographic questionnaire was a researcher-developed structured tool designed to capture baseline characteristics of the nursing staff. This tool was to collect data to provide background information on variables that could influence competence in PIC processes. It had four main components: years of service (<5, 1–5, 5–10, >10 years), department (medical or surgical), educational level (certificate, diploma, degree, masters), and professional position (Nursing Officer III, II, I, or Senior Nursing Officer). All questions were closed-ended with multiple-choice formats for ease of analysis.

Tool 2 For Objective 1: Knowledge Assessment Questionnaire on Evidence-Based Guidelines for PIC-Related Infection Prevention

The researcher-developed questionnaire, was adapted from international IPC and PIC access guidelines. It was aimed at assessing the level of nurses' knowledge on prevention of PIC- related infection.The tool had 10 items, each with a yes/no/I don't know response format. The questions included choice of cannula gauge, appropriate veins for cannulation, recommended duration use, early recognition of phlebitis, the environmental factors, hand hygiene, glove use, skin preparation, and risk factors for infection. Each correct answer was scored as 1 point, while incorrect or "I don't know" responses scored 0, with a total possible score of 10 points. Scores were interpreted as poor (0–3), moderate (4–6), or good knowledge (7–10).

Tool 3 For Objective 2: Perceived Clinical Competence Questionnaire

The clinical competence questionnaire was a researcher-developed, structured self-report tool. It was adapted from standard nursing procedural guidelines and clinical practice standards. It was used for self assessment of nurses on their clinical practice on PIC care. The tool contained 10 items, each rated on a 3-point Likert scale (Always = 2, Sometimes = 1, Not at all = 0). The items in the tool included replacing cannulae within 72 hours, managing phlebitis, securing with transparent dressing, documentation, use of administration sets, awareness of complications, adherence to aseptic technique, skin preparation, knowledge of risk factors, and adherence to hospital policies. The maximum possible score was 20 points, with a higher scores showing greater self confidence on pIC care. Scores were categorized as low (0–7), moderate (8–14), and high competence (15–20).

Tool 4 For Objective 2: Observed Clinical Skills using Observation Checklist for prevention of PIC related infections.

The observation checklist was a structured non-participant observation tool, adapted from the Kenya Ministry of Health clinical procedures manual. It assessed actual nursing practices minimizing self-report bias. The tool had 61 items which were divided into preparation (e.g., indication, consent, equipment gathering, hand hygiene), insertion (e.g., aseptic technique, site selection, tourniquet application, cannula insertion), post-insertion care (e.g., dressing, flushing, documentation), and removal or replacement. Responses were recorded as done or not done. Each correct practice was scored 1 point, while non-performance scored 0, with a total score range of 0–61. Observations were done by research assistants unannounced to reduce the Hawthorne effect, and every nurse was assessed once during routine practice.

Objective 3: Competence was analyzed by combining scores from the Knowledge Assessment Questionnaire, which had 10 items with a maximum score of 10, and the Observation Checklist, which contained 61 items with a maximum score of 61. Each nurse was observed once during routine clinical PIC care using the unannounced Observation Checklist and filled the Knowledge Questionnaire on the same day. A score of ≥50% showed adequate knowledge. The cut-off was based on the nursing council for professional registration of nurses in Kenya (Nyangena et al., 2013).

Observed skills items were similarly scored 1 if the practice was performed and 0 if not, resulting in an overall skills score ranging from 0 to 61, with a score of 50% or more indicating adequate clinical skill. A nurse was said to be competent if she achieved both thresholds (knowledge ≥50 and skills ≥50), while those not meeting one or both thresholds were said to not be competent.

Reliability and validity

Data collection was done between March 19th and May 19th, 2018, and each data collection lasted approximately 30 minutes. The study tools were taken through checks for reliability and validity to ensure accuracy and consistency of findings. Content validity was done by having every tool evaluated for clarity, relevance and alignment with existing guidelines by experts who included IPC coordinator, clinical nurse educators and nurses practising on clinical areas. Face validation was used for the demographic tool.

Pilot study

Pilot study was done at a facility with similar characteristics as the ones for the main study and small group of nurses were used for the pilot study. Carrying out the pretest study helped the researcher identify ambiguity, redundancy and other challenges which could affect data collection procedures.The feedback from pilot participants refined the data collection tools and ensured maintained relevancy. There was a training planned for the research assistants to harmonize data collection approach as well as minimize observer bias. Cohen's kappa coefficient measured inter-rater reliability between the research assistants. A value of ≥0.80 was attained illustrating a high level of agreement.

3.9 Data Analysis

After data collection, there was verification of the data and forms to ensure completeness, then data was entered into excel spreadsheet. The data collected was first cleaned and coded before being entered into the spreadsheet. The data was then imported into SPSS version 21 for analysis stage. The data collection tools filled more than 70 % were included for analysis. Two forms had more than 30% data missing hence excluded. The data was cross checked for discrepancies before final cleaning.

Computation was done for composite scores on knowledge and skills levels and a dichotomous variable was generated for competence status.

Descriptive statistics were used to generate frequency distribution of socio- demographic, and knowledge and level of knowledge. The 50% cut off was based on the passmark of Nursing Council of Kenya (Nyangena et al., 2013). Nurses who scored correctly on 50% or more on knowledge items were considered knowledgeable. The relationship between demographic traits and knowledge level was examined using the Chi square test. Logistic regression was employed for additional analysis to evaluate the correlation between demographic characteristics and knowledge level (p-value < 0.05). Descriptive statistics were used to generate frequency distribution, and performance of insertion, in inserting, removing, and caring for peripheral intravenous cannulae.

Skilled nurses were those who answered correctly on at least 50% of the 61 skill items. The chi square test was employed to examine the relationship between skill level and demographic attributes. Logistic regression was employed for additional analysis to evaluate the correlation between demographic characteristics and knowledge level (p-value < 0.05).

For one to be competent, one must be skilled and knowledgeable. Descriptive statistic was used to generate frequency distribution of the level of competence. Chi square was used to show the association between level of competence of nurses and demographic characteristics. Level of significance were set at $P= 0.05$. The analysed data were presented in charts and tables.

3.10 Dissemination of Research Findings

The Masinde Muliro University of Science and Technology and the Ethics committee each got the research report. It also made available as abstracts to the various healthcare facilities. Additionally, the report was presented at conferences and published in specific journals.

3.11 Ethical Considerations

Informed consenting: Before they took part in the study, the participants were informed of its nature and goal. They were made aware of their right to refuse to participate in the study whenever they wished without suffering any repercussions. The participants were made aware that their participation

in the exercise was entirely voluntary and that no rewards or favors were granted. They were made aware that participating in the study would not endanger their physical or mental health. They were assured that their participation would not endanger their psychological, emotional, social, or physical health.

Confidentiality of data collected: Without their consent, the information would not be disclosed or used for another purpose. In order to protect the participants' identities, their information will be kept private and anonymous while being published. At the same time, no information on their family members would be shared with outsiders. This was done to safeguard the participants' welfare and rights while lowering their risk of bodily or psychological injury or danger from research procedures.

Respect: The participants' autonomy and right to self-determination in making judgments and decisions for themselves were demonstrated by having them acknowledge these rights.

Beneficence: Ensuring the research provides benefits and contributes to the well- being of participants or society.

Voluntary Participation: Ensuring that participation is completely voluntary and not coerced.

Approval: The 2010 Kenyan Constitution places a strong focus on each individual's rights. Because everyone has intrinsic dignity, they should all be treated with respect. The Masinde Muliro University of Science and Technology Research and Ethical Committee was consulted for ethical approval. The approval number MMU/COR.403012(7). Professionally, the researcher was supposed to defend the rights of the participants and shield them from harm. While gathering data, the chief researcher made sure she acted professionally. We shall ask the on-duty nurse for authorization before approaching any participant. NACOSTI was also asked for their permission. The NACOSTI reference number NACOSTI/P/18/30556/21286.

CHAPTER FOUR RESULTS

4.1 Selected socio-demographic characteristics

The socio-demographic characteristics of health care providers in the medical surgical units are shown in Table 4.1. of the 86 participants, more than half (58.1%) had less than 5 years' experience in nursing profession. Nearly three-quarters (73.3%) were diploma level nurses with most of the respondents (59.3%) working in Medical Wards. A higher proportion of participants were Grade III Nursing Officers (62.8%) while Nursing Officer I was least represented (11.6%).

Table 4.1 Selected socio-demographic characteristics of Nurses (n=86)

Variable	Categories	Frequency	Percentage
Years of Service	1 – 4	50	58.1
	5 - 9	33	38.4
	>10	3	3.5
Educational level	Certificate	7	8.1
Diploma		63	73.3
Degree		15	17.4
Masters		1	1.2
Department	Medical	51	59.3
Surgical		35	40.7
Position	Nursing Officer III	54	62.8
	Nursing Officer II	22	25.6
Nursing Officer I		10	11.6

4.2 Nurses' knowledge on preventive interventions for peripheral intravenous cannulae –related infections

Knowledge on evidence-based guidelines for preventive interventions for peripheral IV cannulae-related infections was assessed by asking study participants to respond to 10 items with a 'Yes', 'No' or 'I don't know' responses as presented in Table 4.2.1 'Yes' responses were considered as correct answer to the statements. All the correctly confirmed that skin preparation at insertion site is required before IV cannula is inserted. 79.1% of the nurses knew the size of the cannulae gauges that are suitable for peripheral intravenous cannulation. Additionally, more than 90% accurately stated that wearing non-sterile gloves during IV cannula insertion is advised (97.7%) and

that adhering to aseptic technique during cannula insertion alone will help prevent infection from occurring (97.7%). The question about when the peripheral IV cannula should be removed from its insertion site—which should occur every 12 to 72 hours—seems to have the lowest percentage of respondents who correctly answered (36.1%), suggesting a knowledge gap in this area.

Table 4.2. Knowledge on on preventive interventions for peripheral intravenous cannula-related infections

Variable	Responses	N	%
A cannula with a gauge 14G, 16G, 18G and 20G are suitable to apply for peripheral intravenous cannulation	Yes	68	79.1
	No	5	5.8
	Don't know	13	15.1
The veins used for intravenous cannulation are typically found in the metacarpal, cephalic, and basilic regions of the right and left upper extremities	Yes	61	70.9
	No	23	26.7
	Don't know	2	2.3
After insertion, the peripheral IV cannula needs to be taken out every 12 to 72 hours	Yes	31	36.1
	No	55	63.9
According to UIC guidelines, an IV cannula can be used for 48 to 72 hours if there are no indications of a problem	Yes	61	70.9
	No	25	29.1
The most recognizable infection associated with IV cannulation is phlebitis	Yes	54	62.8
	No	32	37.2
Will the state of the environment (such as cleanliness) affect the risk of infection associated with IV cannulation?	Yes	74	86.1
	No	12	13.9
Will infection occur if aseptic technique is maintained only during IV cannula insertion?	Yes	84	97.7
	No	2	2.3
It is recommended to wear non-sterile gloves when inserting an IV cannula	Yes	84	97.7
	No	2	2.3
Prior to the insertion of the IV cannula, the insertion site must be prepared	Yes	86	100.0
	No	0	0.0
An increase in cannulation attempts will raise the infection risk	Yes	73	84.9
	No	13	15.1

4.2.2. Level of Nurses Knowledge on evidence-based guidelines for preventive interventions for peripheral intravenous cannula-related infections

Knowledge of nurses were further classified into knowledgeable and not knowledgeable based on the Nursing Council of Kenya clinical assessment pass grade. Nurses who scored correctly in (≥50%) or greater than five on knowledge items were considered knowledgeable and those who scored (<50%) less than 5 were not knowledgeable. Majority 68(78.6.0%) of the nurses were knowledgeable while 24 (21.4%) were not knowledgeable on evidence-based guidelines for preventive interventions for peripheral intravenous cannula-related infections as indicated in Figure 2

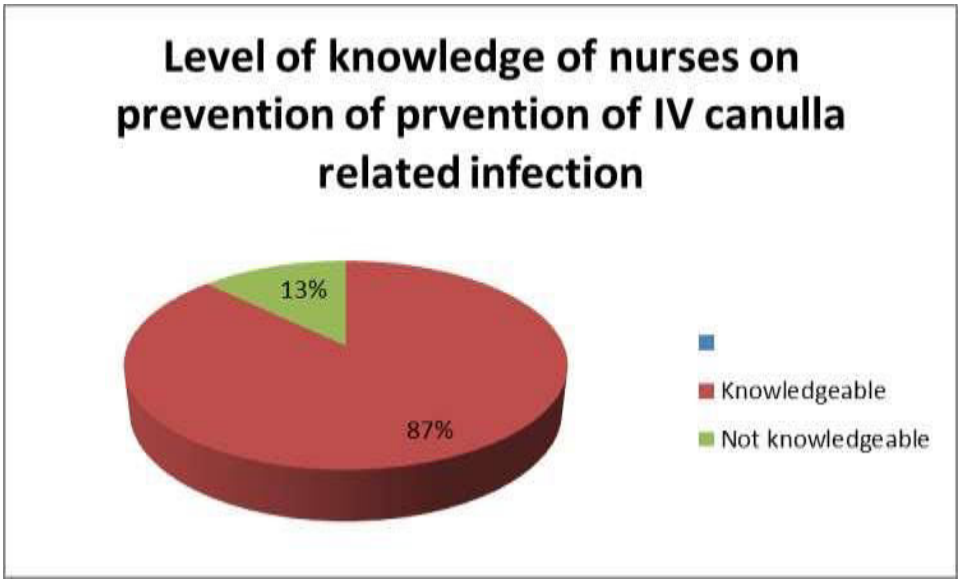

Figure 2: Nurses' knowledge level on evidence-based guidelines on preventive interventions for IV cannula-related infections

4.3.Nurses' Perceived Clinical Skills in Prevention of Peripheral Intravenous Cannulae Related Infection

Majority of nurses always are aware of the factors contributing to infection occurence (95.4%), the importance of cleaning the skin as preparation for insertion of IV cannula (93.3%) and of complications of documented for IV cannulation for instance infiltration, phlebitis and extravasation (90.7%).

However, only 5.8% and 9.3% always change IV cannula after 72 hours inserted or always follow guidelines that are given by the hospital when carrying out IV cannulation, respectively. The results suggest higher awareness level but lower levels in terms of correct practice.

Self-reported nurse's competence in insertion, removal and caring for peripheral IV cannulae.

4.3. Nurses' perceived Clinical skills in Prevention of Peripheral Intravenous Cannulae Related Infection

Variable	Responses	Freq.	%
I always replace the IV cannula 72 hours after it is inserted.	Always	5	5.8
	Sometimes	81	94.2
	Not all	0	0.0
As soon as I noticed a phlebitis symptom, I switched the IV cannula to the unaffected area.	Always	61	70.9
	Sometimes	12	14.0
	Not all	13	15.1
I always secure the IV cannula using transparent dressing.	Always	14	16.3
	Sometimes	72	83.7
	Not all	0	0.0
I always include the date, time, location, size, change in the due date, and the name of the cannulated person.	Always	9	10.5
	Sometimes	77	89.5
	Not all	0	0.0
I use IV cannula administration sets within 72 hours.	Always	16	18.6
	Sometimes	45	52.3
	Not all	25	29.1
I am aware that IV cannulation can result in complications such as infiltration, phlebitis, and extravasation.	Always	78	90.7
	Sometimes	8	9.3
	Not all	0	0.0
I always prepare, insert, and remove IV cannulas using aseptic technique.	Always	22	25.6
	Sometimes	64	74.4
	Not all	0	0.0
I understand how crucial it is to prepare the skin before inserting the IV cannula.	Always	80	93.0
	Sometimes	6	7.0
	Not all	0	0.0
I am aware of the variables that affect the likelihood of contracting an infection.	Always	82	95.4
	Sometimes	4	4.6
	Not all	0	0.0
I always perform IV cannulation according to the instructions provided by my hospital	Always	8	9.3
	Sometimes	78	90.7
	Not all	0	0.0

4.4. Observed Nurses' Clinical Skill to Prevent PIC Related Infections

Further analysis classified competence level into skilled and not skilled according to Nursing Council of Kenya clinical assessment pass grade based on 61 items that were assessed. Most nurses (70%) were skilled skills on performing intravenous therapy on inserting, removing, and caring for peripheral intravenous cannula while nurses who were not skilled comprised 30% as shown in table 4.4.1 below. A passmark of 50% as per the nursing council of kenya was used (Nyangena et al., 2013)

Observation checklist of procedural skills to prevent PIC- related infection (n = 86)

Skill Category	Score Range (%)	Frequency (n)	Percentage (%)
Low Skill	0 – 49	26	30.2%
Adequate Skill	50 – 100	60	69.8%
Total	—	86	100%

Table 4.4: Observed Nurses' Clinical Skills to prevent PIC -related infections

4.5 Level Of Nurses Competence On Prevention of Peripheral IV Cannulae- Related Infection

Competence among nurses on preventive interventions for peripheral intravenous cannula (PIC)–related infections was assessed by combining their performance on the Knowledge Assessment Questionnaire and the Observation Checklist. The knowledge questionnaire comprised 10 items, while the observation checklist contained 61 items assessing real-time clinical practices. A nurse was classified as competent if they scored at least 50% on both tools, representing adequate knowledge and adequate clinical skill, as guided by the Nursing Council of Kenya professional standards (Nyangena et al., 2013).

The findings from the analysis of both knowledge and skills showed nearly two-thirds of the nurses, 66.3%, were competence in the prevention of PIC-related infections. On the other hand, 33.7% of the nurses did not meet the competency minimum score, indicating gaps in either knowledge, skills, or both. These results suggest that while most nurses possess satisfactory competence in PIC infection

prevention, there remains a significant proportion who may benefit from targeted capacity-building and continuous professional development to enhance adherence to evidence-based infection prevention practices.

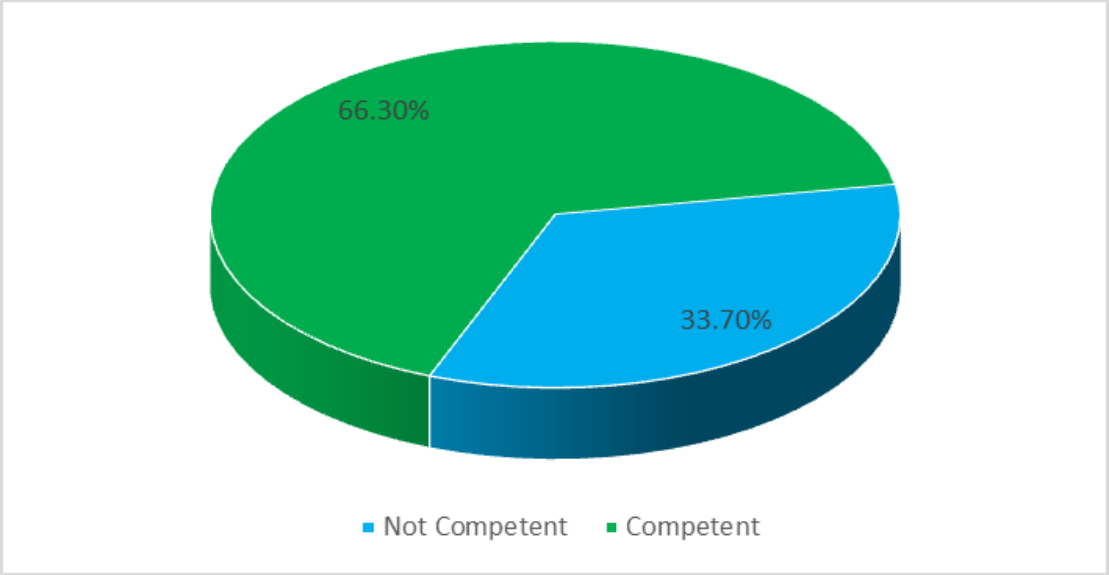

Figure 3. Competence On Preventive Interventions For Peripheral Intravenous Cannula –Related Infections.

4.6 Association between Demographic characteristics and knowledge Level of Nurses on evidence-based guidelines for preventive interventions for peripheral intravenous cannula-related infections

The proportion of those who were knowledgeable were higher among those who had taken < 5 years and those who had taken >=10 years respectively each representing 100% compared to those who were not knowledgeable. Similarly, all nursing officer I were knowledgeable (100%). Further univariate analysis by Chi square showed that level of education (F=6.74: P=0.03) and work experience of nurses (F=8.35: P=0.02) were significantly associated with their knowledge level on evidence-based guidelines on preventive interventions for IV cannula-related infections (P≤0.05). However, department and department of the operations of the nurses were not significant as indicated in Table 4.6.1

Table 4.6.1: Association Between Nurses' Demographic Characteristics and Knowledge on Prevention of Peripheral Intravascular Cannula-Related Infections (n=86)

Variable	Category	Knowledgeable n (%)	Not Knowledgeable n (%)	Chi-square (χ^2), p-value
Years of Experience	< 5 years	50 (100.0)	0 (0.0)	6.74, p = 0.03
	5–9 years	22 (66.7)	11 (33.3)	
	>10 years	3 (100.0)	0 (0.0)	
Educational Level	Certificate	7 (100.0)	0 (0.0)	8.35, p = 0.02
	Diploma	56 (97.2)	7 (2.8)	
	Degree	11 (75.0)	4 (25.0)	
	Masters	1 (100.0)	0 (0.0)	
Department	Medical	48 (94.1)	3 (5.9)	0.73, p = 0.62
	Surgical	34 (96.3)	1 (3.7)	
Position	Nursing Officer I	10 (100.0)	0 (0.0)	0.77, p = 0.68
	Nursing Officer II	20 (93.3)	2 (6.7)	
	Nursing Officer III	45 (95.7)	9 (4.3)	

Note: Statistically significant association observed at $p < 0.05$ between years of experience, educational level, and knowledge on PIC-related infection prevention.

4.6.2 Logistic regression analysis showing cluster difference in and knowledge Level of Nurses on prevention of peripheral intravenous cannula-related infections

As shown in Table 4.4, Nurses who were aged who had 5-9 years working experience (OR = 1.5, 95% CI: 1.21-1.89; P= 0.030) were 1.5 times more knowledgeable as compared to those had less than 5 years' experience. Similarly, Nurses who were holders of attained bachelor degree were 1. 8 times more knowledgeable on evidence-based guidelines for preventive interventions for peripheral intravenous cannula-related infections (OR = 1.8, 95% CI: 1.32-2.07; P=0.010). In addition, Nursing officer II and III were 6% and 5 % (OR = 0.95, 95% CI: 0.88-1.03; P=0.010) and OR = 0.96, 95% CI0.86-1.03; P=<0.001) respectively less likely to be knowledgeable on evidence-based guidelines for

preventive interventions for peripheral intravenous cannula-related infections than Nursing Officer I.

Table 4.6.2 Logistic Regression Analysis Showing Cluster Differences in Knowledge Level of Nurses on Prevention of Peripheral Intravenous Cannula–Related Infections

Factor	Level	OR (95% CI)	p-value
Years of experience	5–9 years	0.98 (0.96–1.01)	0.550
	1–4 years	1.50 (1.21–1.89)	0.030
Educational level	Masters	1.98 (0.92–2.05)	0.200
	Degree	1.81 (1.32–2.07)	0.010
	Diploma	1.01 (0.96–2.06)	0.150
	Certificate (Ref)	—	—
Department	Surgical	1.02 (0.94–1.10)	0.480
	Medical (Ref)	—	—
Position	Nursing Officer III	0.95 (0.88–1.03)	0.010
	Nursing Officer II	0.94 (0.86–1.03)	<0.001
	Nursing Officer I (Ref)	—	—

4.6.3 Logistic regression analysis showing cluster difference in competence of Nurses on evidence-based guidelines for preventive interventions for peripheral intravenous cannula-related infections

As shown in Table 4.9, Nurses who had over 10 years of experience working experience and 5-9 years of experience (OR = 1.53, 95% CI: 1.36-1.72; P= <0.001) and OR = 1.22, 95% CI: 1.17-1.81; P< 0.05) were 1.53 times and 1.22 times respectively more competent as compared to those had less than 5 years' experience. Similarly, Nurses who were holders of Master degree and Diploma were 1.64 times and 1.43 times more skilled on evidence-based guidelines for preventive interventions for peripheral intravenous cannula-related infections (OR = 1.64, 95% CI: 1.17-2.3; P=<0.001) (OR = 1.43, 95% CI: 1.04-1.97; P= 0.029) respectively than those were certificate holders. In addition, Nursing officer II

were 23% (OR = 0.77, 95% CI: 0.59-1.02; P=0.041) less likely to be competent on preventive interventions for peripheral intravenous cannula-related infections than Nursing Officer I.

Table 4.6.3 Logistic regression analysis showing cluster difference in Competence of Nurses on preventive interventions for peripheral intravenous cannula-related infections

Factor	Category	OR (95% Cl)	p value
Years of experience	>=10	1.53(1.36-1.72)	<0.001
	5-9 years	1.22(1.17-1.81)	0.05
	<5years	Ref	
Educational level	Masters	1.26(1.10-1.45)	<0.001
	Degree	1.5(0.96-6.33)	0.10
	Diploma	1.43(1.04-1.97)	0.029
	Certificate	Ref	
Department	Surgical	1.27(0.59-2.3)	0.73
	Medical	Ref	
Position	Nursing officer III	0.84(0.65-1.09)	0.186
	Nursing officer II	0.77(0.59-1.02)	0.041
	Nursing officer I	Ref	

4.6.4 Univariate analysis of association between demographic factors and level of competence of nurses on preventive interventions for peripheral intravenous cannula –related infections

When demographic factors were associated with level of competence of nurses on preventive interventions for peripheral intravenous cannula –related infections in univariate analysis using chi square it was found that only year of experience and education were significantly associated with competence at P value =0.05.

Table 4.6.4 Univariate analysis of association between demographic factors and level of competence of nurses on preventive interventions for peripheral intravenous cannula –related infections

	Demographic	**Competence**		**Chi**	**P- value**
		Not Competent	Competent	Chi square	
Years of experience	< 5years	12(24.0)	38(76.0)	8.32	
	5-9 years	17(51.5)	16(48.5)		0.02
	>=10	0(0.0)	3(100)		
Education	Certificate	4(57.1)	3(42.9)	5.21	0.05
	Diploma	21(29.6)	50(70.4)		
	Degree	4(50.0)	4(50.0)		
Department	Medical	19(37.3)	32(62.7)	0.76	
	Surgical	10(29.6)	25(70.4)		0.68
Position	Nursing officer I	2(20.0)	8(80.0)	3.76	
	Nursing officer II	14(46.7)	16(53.3)		
	Nursing officer III	13(28.3)	33(71.7)		0.16

CHAPTER FIVE DISCUSSION

5.1 Socio-Demographic Characteristics

More than half of the participants (58.1%) had less than five years of experience in the nursing profession. This concurs with the study by Odonkor and Frimpong (2020), which assessed burnout among healthcare professionals in Ghana, provided insights into the socio-demographic characteristics of the health workforce. It revealed that more than half of the respondents (52.1%) were aged between 20 and 30 years, 49.3% had 1–5 years of work experience, and the majority were nurses (65.2%). The study illustrated a young population that is in their early career as the workforce in healthcare system reflecting increased recruitment of younger nurses to meet healthcare demands in sub-Saharan region.

Similarly, Adams et al. (2020), in their research done on "nurses' knowledge and attitudes towards postoperative pain management" in Ghana, concluded majority of participants were within the 23–39-year age range, a mean age of 29.7 years, and most (62.1%) had attained diploma. Their findings supported the recent study showing that the nursing profession in Ghana is dominated by a younger nurses with few years of experience. This is consistent with a trend seen in sub-Saharan African countries. The authors attributed this to the the nursing education systems that prioritize and strengthen diploma training, making it more accessible and cost-effective than degree-level education.

Together, these studies show common workforce profile in the region, young, mostly female, and diploma-trained nurses working in healthcare facilities.

The findings on demographic structure supporting younger workforce and new professional entry into healthcare systems, there is a need for mentorship, in-service training and continuous nursing education to enhance retention and nursing competence. The trends observed suggest that despite the younger workforce being full of energy their limited years of experience could affect their competence in patient care procedures including PIC.

In contrast, Heidari et al. (2022) did a descriptive correlational study which explored job satisfaction

and burnout among nurses working in COVID-19 wards in Iran. The study revealed a different demographic pattern compared to findings from studies conducted in sub-Saharan Africa. Like the other studies, the workforce was dominated by females (62.2%) with a mean age of 29.76 years, and 95.6% of the nurses had a bachelor's degree with only 4.4% had a master's degree. In addition, more than half (55.4%) of the participants had <5 years of work experience, and the majority (78.1%) resided in urban settings. This was different with findings from African healthcare settings. The difference reflects the difference in priorities of high and middle income countries. In developed countries the focus is university-trained and entry into nursing profession requires a degree. It highlights differences in preparation for nursing across regions. Degree trained nurses are academically prepared, potentially influence their competence, clinical decision-making, and advancement opportunities.

5.2 Nurses' knowledge on preventive interventions for peripheral intravenous cannulae –related infections

The findings illustrate high level of knowledge among nurses on IPC practices, in relation to skin preparation prior to PIC insertion. All participants (100%) identified the need for proper skin preparation at the insertion site, which would prevent PIC -related infections. This finding concurs with García-Expósito et al. (2021), who, in a mixed-methods study assessed what nursing students' learnt on PIC care. He found that 70.7% of participants identified the appropriate concentration of chlorhexidine that should be used for skin disinfection before PIC insertion. The study emphasized that educational interventions and simulation-based training contributes to increased level of knowledge and compliance with IPC standards.

In contrast, Aydoğdu and Akgün (2020), in their cross-sectional study which assessed nurses' knowledge of central venous catheter care in Turkey, concluded that 50% of nurses were unaware that chlorhexidine should be used for site preparation. This showed knowledge gaps and inconsistent adherence to IPC guidelines. This discrepancy reflects varied training, resources, and institutional

emphasis on IPC.

Another study that supports the research was done by SH and Rani (2021). They did a study on nurses' knowledge and skills in PIC care. They found that while some nurses showed adequate understanding, a considerable proportion (68.8%) had only average knowledge, and 20.8% had poor knowledge on PIC and related IPC measures. This suggests that there is a risk of suboptimal awareness of aseptic principles, practical understanding and retention of protocols.

Approximately 79.1% of nurses illustrated knowledge of the appropriate cannula gauge sizes for peripheral intravenous cannulation, whch showed a fair level of knowledge. This is consistent with the findings of Osti et al. (2019), who evaluated nurses' knowledge and practice toward PIC care at Chitwan Medical College Teaching Hospital in Nepal. They reported that majority of nurses were knowledgeable which would not translate into actual practice. Their study showed that despite theoretical knowledge, challenges such as inadequate supervision and resource constraints often hinder optimal IPC practice.

These studies discuss the importance of using knowledge for actual clinical practice. While awareness levels may be high, there are challenges in the application of IPC protocols, such as the use of chlorhexidine, timely cannula replacement, and adherence to aseptic technique. Strengthening continuous professional education, adequate infection prevention supplies, and institutional support for IPC compliance monitoring are steps that can be taken towards minimizing PIC-related infections and improves patient safety.

5.3 Nurses' clinical skills in prevention of peripheral intravenous cannulae Related Infection

AS per the self assessment,nurses had a high level of awareness although compared to adherence to actual clinical skills on PIC procedures. Majority of the nurses (95.4%) stated they were always aware of factors that influence the risk of infection, and 93.3% could recognize the importance of skin preparation before PIC. Also, 90.7% were aware of phlebitis, infiltration, and extravasation as potential

complications which suggests a high level of knowledge and awreness of IPC guidelines. On the other hand,clinical practice was lower with only 5.8% changing PIC after 72 hours, and 9.3% following hospital guidelines during PIC. It is a difference that reflects a trend in clinical nursing pattern where being aware and having adequate knowledge does not translate into practice.

One study that concurs with these findings is one by Timsina et al., (2024),which was done on "Peripheral Cannula Infection: Nursing Assessment at Diaconia University of Applied Sciences" emphasizes PIC competence demands more than adequate knowledge but also confidence and strictly adhering to IPC guidelines. From their literature, it stated that that prevention of infections is linked to integrating knowledge with self efficacy and clinical skills. It discussed self assessment tool as being effective in measuring nurses' level of understanding and confidently adhering to IPC protocols which lack of indicates comptency gaps.

Moreover, Timsina et al., (2024) discussed education and development of skillsto being central to improved PIC care. The self assessment in the current research agrees with this. The competency gap stems from inadequate clinical supervision and lack of simulation. The results indicates a need for continuous medical education which is aimed at bridging the gap between knowledge and skills including refresher trainings and mentorship. The use of validated self assessment tools can lead to high level of awareness and consistency in practice. It can also foster accountability and continued improvement which would ensure that nurses implement IPC guidelines and hospital policies in managing patients. From the study, there is a persistent gap between knowledge and clincial practice even when the self assessment tool is looked at. Most nurses stated they were aware of IPC activities in PIC, but low adherence to hospital protocols. This showed similarchallenge in ensuring evidence based-practice in the world.

Raynak et al., (2020) supported the same observation. They carried out a scoping review on PIC care and maintenance among nurses. It stated that majority identified aseptic technique and skin antisepsis

as being important but had varied compliance to the standards across facilities. The variance was attributed to work pressures,insufficient monitoring systems and limited support from healthcare facilities for competency. It aligns with this study where there was a high level of awareness but it did not translate into clinical skills. SH and Rani (2021) stated that nurses have moderate to high level of knowledge with only a third demonstrating high level of clinical skills on PIC. They states poor adherence to IPC measures is linked to inadequate training and absence of structured competency assessments after supervision.

The findings from all these studies highlight the fact that high level of knowledge does not translate into competence. It also supports the idea that cognitive, psycho motor and environment are important in bridging the gap between knowledge and skill. When these components are strengthened, it would contribute to reduced PIC -related infections and improve patient outcomes through IPC protocols.

5.4 Nurses' competence on prevention of intravenous cannulae-related infections

The findings of the present study show that nearly two-thirds (66.3%) of nurses illustrated competence in PIC -related infections, while 33.7% were not competent. This finding show majority of the nurses are proficient. However, all nurses are expected to be competent. A study that concurs with this one is by Jacobs (2022). He states in his study there was a 76% competence on PIC among medical-surgical nurses who had undergone blended simulation and online training. The study showed that training enhances confidence and skill in PIC and resulted on 30 days sustained improvement post-intervention ($p < 0.001$). This is in line with present study affirming hands on practice,clinical field supervision to reinforce application of knowledge and skills.

Moreover, Mohamed et al (2011) found that after a program implementation on hand hygiene,use of gloves, technique of insertion, applying the dressing, disposal of waste and documentation, the nursing practice improved significantly ($p < 0.001$). This was in their study "Effect of Training Program on Nurses' Practice Regarding Infection Control in Caring for Patients with Peripheral Intravenous

Cannulae". There was an increased mean practice score in the post program compared to pre-program phase. These results indicates education and reinforcement of IPC principles enhance knowledge and promote clinical practice and procedural changes among nurses.

All the studies show that ongoing professional education and simulation based learning build and maintains competence in preventing PIC-related infection prevention.

Study done by Timsina et al. (2024) illustrates PIC care require practice, critical thinking, self confidence and adherence to aseptic non-touch technique. A nurse who continuously practice PIC care gets their skills refined which is also supported by continuous assessment and mentorship.

The findings from these studies, including the current one, show that competnce on prevention of PIC - related infection is determined by knoweldge and skill, which should be enhanced by the healthcare facilities through fostering culture of learning and accountability.

5.5 Relationship between selected demographic factors

5.1.1 Relationship between nurses' demographic characteristics and competence on prevention of intravenous cannulae-related infections

The findings of this study illustrates a strong association between nurses' years of experience, level of education, and competence in preventing PIC-related infections. They are consistent with study donen by Nordin et al. (2023). Their research was done among nurses in Malaysian and established that clinical practice was a statistically significant factor ($p<0.05$). It illustrated nurses' knowledge influenced clinical practice in prevention of phlebitis. They found that nurses with longer years of experience had greater understanding of infection risk factors and higher adherence to preventive measures compared to those with few years of experience.

This alignment shows that continued practice is important to nursing competence, especially in PIC procedures. As the current study supports this as it illustrated nurses with more than 10 years of

experience demonstrated 100% competency. This shows that clinical maturity supports knowledge and skills proficiency in IPC practices.

Also, level of education was strongly associated with competence. Nurses with diplomas and degrees demonstrated higher competency levels (70.4% and 50.0%, respectively) compared to certificate holders (42.9%) suggesting that advanced level of education strengthens understanding and emphasizes on clinical skills. Privitera et al. (2023) concurs, and they stated that multimodal educational strategies and continuous assessments on IPC adherence significantly reduce catheter-related infections. In addition, Ray-Barruel and Alexander (2023) state that clinicians responsible for catheter procedures must be trained and operate within expected standards to maintain safety of patients and quality of care. However, while knowledge and skills were strongly associated with competence, some statistical associations were not significant, such as years of experience ($\chi^2 = 4.55$, $p = 0.10$) and education level ($\chi^2 = 2.65$, $p = 0.27$). This could be attributed to the small sample size or unit-level clustering, which reduced statistical power. The trend observed on descriptive and logistic analyses shows that higher level of education and years of experience influenced nurses' competence in preventing PIC-related infections positively. The results show that nursing competence in prevention of PIC -related infections is multi-factorial, influenced by knowledge and skills. Institutions should place emphasis on continuous professional development, training programs, and competency assessments to sustain nurses' competency in IPC practices.

CHAPTER SIX CONCLUSION AND RECOMMENDATION

6 Introduction

6.1.1 Objective 1: Nurses' knowledge on preventive interventions for PIC–related infections

Most nurses had adequate knowledge on fundamental principles of IPC, but there were knowledge gaps concerning the appropriate duration for cannula use and adherence to institutional policies.

6.1.2 Objective 2: Nurses' skills in prevention of PIC–related infections

Majority were not skilled in changing PIC after 72 hours and adhering to hospital protocols.

6.1.3 Objective 3: Nurses' level of competence on preventive interventions for PIC–related infections

High level of competence was among nurses with more years of experience and higher level of education.

6.2 Recommendations

6.2.1 Objective 1: Nurses' knowledge on preventive interventions for PIC–related infections

There is need to maintain contionuous nursing educations, simulation - based learning and timely updates of knowlegde.

6.2.2 Objective 2: Nurses' skills in prevention of PIC–related infections

The ministry of health and county government should facilitate vigorous training and adherence to IPC protocol by the IPC coordinators.

6.2.3 Objective 3: Nurses' level of competence on preventive interventions for PIC–related infections

Nurses to be maintained without frequent transfers to facilitate mentorship, skills transfers and in service training. The nurses should be encouraged to advance their education from certificate to diploma and diploma to degree levels and further.

REFERENCES

Adams, S. D. M., Varaei, S., & Jalalinia, F. (2020). Nurses' knowledge and attitude towards postoperative pain management in Ghana. *Pain research and management*, *2020*. https://doi.org/10.1155/2020/4893707.

Africa Centres for Disease Control and Prevention (Africa CDC). (2023, September 2). *Africa CDC Strategic Plan 2023 – 2027*. Africa CDC. https://africacdc.org/download/africa-cdc-strategic-plan-2023-2027/

Aydoğdu, S., & Akgün, M. (2020). Determination of knowledge levels of nurses and the factors affecting the level of knowledge in central venous catheter care. *Clinical Nursing Studies*, *8*(2), 1-9. https://www.sciedupress.com/journal/index.php/cns/article/view/17246.

Bai, R. R. (2022). Effectiveness of Proximal Massage and Palm Fisting in Reducing the Risk of Thrombophlebitis among Intravenous Cannulated Inpatients. Indian Journal of Nursing Sciences| Volume, 7(1). https://doi.org/10.31690/ijns.2022.v07i01.004.

Behairy, A. S., Abdel Hakeim, E. H., El-Naby, A., & Gomaa, A. (2023). Effect of Nursing Training Regarding Peripheral Intravenous Cannula on Nurses Performance and Incidence of Complications. Assiut Scientific Nursing Journal, 11(38), 100-111. DOI: 10.21608/asnj.2023.222434.1634.

Centers for Disease Control and Prevention. (2025, June 12). Infection control basics. Retrieved from https://www.cdc.gov/infection-control/about/index.html.

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.ISBN 1506386709.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. Psychological Inquiry, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01.

Elli, S., Mattiussi, E., Bambi, S., Tupputi, S., San Fratello, S., De Nunzio, A., ... & Lucchini, A. (2020). Changing the syringe pump: a challenging procedure in critically ill patients. The Journal of Vascular

Access, 21(6), 868-874. https://doi.org/10.1177/1129729820909024.

Farizon, M., Dos Santos, S., Richard, L., Petiteau, A., Valentin, A. S., & Van Der Mee- Marquet, N. (2023). Impact of a training strategy on improving compliance of hand hygiene and gloving during the placement of a short peripheral venous catheter: the multicentre study CleanHand4. https://doi.org/10.21203/rs.3.rs- 2953401/v1.

García-Expósito, J., Reguant, M., Canet-Vélez, O., Mata, F. R., Botigué, T., & Roca, J. (2021). Evidence of learning on the insertion and care of peripheral venous catheters in nursing students: A mixed study. *Nurse Education Today*, *107*, 105157. https://doi.org/10.1016/j.nedt.2021.105157.

Gašpert, T. (2025). The Vital Role of Nurses in IPC. In *Principles of Nursing Infection Prevention Control: Introduction and global context of Infection Prevention and Control (Volume 1)* (pp. 17-34). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-84469-0_3.

Gould, D. J., Courtenay, M., Gallagher, R., Hawker, C., Chudleigh, J., Purssell, E., & Drey, N. S. (2023). Challenges undertaking procedures requiring asepsis: a qualitative interview study with nurses. Journal of Hospital Infection, 133, 55-61. https://doi.org/10.1016/j.jhin.2022.12.012.

Greene, E. S. (2021). Challenges in reducing the risk of infection when accessing vascular catheters. Journal of Hospital Infection, 113, 130-144. https://doi.org/10.1016/j.jhin.2021.03.005.

Hawthorn, A., Bulmer, A. C., Mosawy, S., & Keogh, S. (2019). Implications for maintaining vascular access device patency and performance: application of science to practice. *The journal of vascular access*, *20*(5), 461-470. https://doi.org/10.1177/1129729818820200.

Heidari, S., Parizad, N., Goli, R., Mam-Qaderi, M., & Hassanpour, A. (2022). Job satisfaction and its relationship with burnout among nurses working in COVID- 19 wards: A descriptive correlational

study. *Annals of Medicine and Surgery*, *82*, 104591. https://doi.org/10.1016/j.amsu.2022.104591.

Irene K, Amubuomombe PP, Wilson A, et al. (2022). Evaluating Hand Hygiene Practices at the New-born Unit of Moi Teaching and Referral Hospital, Eldoret, Kenya . Cardiol Vasc Res; 4(1): 1-7. ISSN 2639-8486.

Jacobs, L. (2022). Peripheral intravenous catheter insertion competence and confidence in medical/surgical nurses. *Journal of Infusion Nursing*, *45*(6), 306-319.

Joseph, S. S., George, R. A., Jose, R., & Sebastian, B. (nd). Application of a Nursing Care Protocol Based on King's Theory of Goal Attainment: a Pre-Experimental Study. https://doi.org/10.53350/pjmhs2115123481.

Kassahun, C. W., Abate, A. T., Tezera, Z. B., Beshah, D. T., Agegnehu, C. D., Getnet, M. A., ... & Alemu, M. T. (2022). Incidence and Associated Factors of Failed First Peripheral Intravenous Catheters among Adult Patients at Medical Surgical Wards in Public Referral Hospitals of West Amhara, Ethiopia, 2021. Nursing Research and Practice, 2022. https://doi.org/10.1155/2022/8261225.

Khairunniza, G., Leela, C., & Thiruselvi, S. (2019). Students'perception Of Their Knowledge About Peripheral Intravenous Cannulation At A Private Medical University In Seremban, Negeri Sembilan, Malaysia. https://www.ocerints.org/adved19_e-publication/papers/105.pdf.

Kim, J. T., Park, J. Y., Lee, H. J., & Cheon, Y. J. (2020). Guidelines for the management of extravasation. Journal of educational evaluation for health professions, 17. https://doi.org/10.3352/jeehp.2020.17.21.

Kouko, D. W. (2023). *Assessment of infection prevention and control knowledge, practices, implementation and barriers among healthcare workers and support staff at Pumwani Maternity Hospital, Nairobi Kenya* (Doctoral dissertation, University of Nairobi). http://erepository.uonbi.ac.ke/handle/11295/165018.

Lacostena-Pérez, M. E., Buesa-Escar, A. M., & Gil-Alós, A. M. (2019). Complications related to the insertion and maintenance of peripheral venous access central venous catheter. *Enfermería Intensiva (English*

ed.), *30*(3), 116-126. https://doi.org/10.1016/j.enfie.2018.05.001.

Lulie, M., Tadesse, A., Tsegaye, T., Yesuf, T., & Silamsaw, M. (2021). Incidence of peripheral intravenous catheter phlebitis and its associated factors among patients admitted to University of Gondar hospital, Northwest Ethiopia: a prospective, observational study. Thrombosis Journal, 19, 1-8. https://doi.org/10.1186/s12959-021-00301-x.

Lv, L., & Zhang, J. (2020). The incidence and risk of infusion phlebitis with peripheral intravenous catheters: A meta-analysis. The journal of vascular access, 21(3), 342-349. https://doi.org/10.1177/1129729819877323.

Maharjan, R., Bhandari, P., & Bahadur Gharti, M. (2020). Aseptic measures during peripheral intravenous (PIV) therapy in health care settings. https://urn.fi/URN:NBN:fi:amk-2020090520126.

Marais, R. (2021). Guidelines for infection control and prevention in anaesthesia in South Africa 2021. Southern African Journal of Anaesthesia and Analgesia, 27(4). ajol-file-journals_199_articles_244576_submission_proof_244576-2365-587277-1-10- 20230326 (1).pdf.

Marsh, N., Larsen, E. N., Takashima, M., Kleidon, T., Keogh, S., Ullman, A. J., ... & Rickard, C. M. (2021). Peripheral intravenous catheter failure: A secondary analysis of risks from 11,830 catheters. International Journal of Nursing Studies, 124, 104095. https://doi.org/10.1016/j.ijnurstu.2021.104095.

Martínez-Martínez, M., Nuvials, F. X., & Riera, J. (2022). Nosocomial infections during extracorporeal membrane oxygenation. Current Opinion in Critical Care, 28(5), 480-485. https://doi.org/10.1097/MCC.0000000000000976.

McGonigle, D., & Mastrian, K. (2024). Nursing informatics and the foundation of knowledge. Jones & Bartlett Learning. ISBN 1284300633.

Mermel, L. A. (2017). Short-term peripheral venous catheter-related bloodstream infections: A review. Clinical Infectious Diseases, 65(10), 1757–1762. https://doi.org/10.1093/cid/cix562

Mrayyan, M. T., Abunab, H. Y., Khait, A. A., Rababa, M. J., Al-Rawashdeh, S., Algunmeeyn, A., & Saraya, A. A. (2023). Competency in nursing practice: a concept analysis. *BMJ open*, *13*(6), e067352. https://doi.org/10.1136/bmjopen-2022-067352.

Ministry of Health Kenya. (2021). *Kenya National Infection Prevention and Control Strategic ...* Kenya National Infection Prevention and Control Strategic Plan for Health Care Services 2021 - 2025. http://guidelines.health.go.ke:8000/media/Kenya_National_IPC_Strategic_Plan_for_Health_Care_Services_2021_-_2025.pdf

Mohamed, M. H. I., Mohamed, M. A. E. A., Mahmoud, M. E. P., & El-Hosany, W. A. E. A. (2021) Effect Of Training Program On Nurses' practice Regarding Infection Control In Caring For Patients With Peripheral Intravenous Cannulae. https://www.researchgate.net/profile/Wafaa-El-Hosany/publication/331000839_EFFECT_OF_TRAINING_PROGRAM_ON_NURSES'_PRACTICE_REGARDING_INFECTION_CONTROL_IN_CARING_FOR_PATIENTS_WITH_PERIPHERAL_INTRAVENOUS_CANNULAE/links/5c609f84a6fdccb608b75f4c/EFFECT-OF-TRAINING-PROGRAM-ON- NURSES-PRACTICE-REGARDING-INFECTION-CONTROL-IN-CARING- FOR-PATIENTS-WITH-PERIPHERAL-INTRAVENOUS-CANNULAE.pdf.

Nordin, N., Bakar, K. B. A., Sharoni, S. K. A., Fauzi, R., & Seman, N. (2023). Assessment of Peripheral Intravenous Catheter (PIC) Knowledge and Perceptions of Phlebitis Risk Factors among Nurses in a University Hospital in Selangor. *The Malaysian Journal of Nursing (MJN)*, *15*(Supplementary 1), 80-92. https://doi.org/10.31674/mjn.2023.v15isupp1.009.

Nyangena, E., Getanda, A., & Ngugi, S. (2013). Factors influencing success of bachelor of science in nursing graduates in nursing council of Kenya licensure examinations. Baraton interdisciplinary research journal, 3(1), 11-21.

https://www.researchgate.net/publication/289523531_FACTORS_INFLUENCING_SUCCESS_OF_BACHELOR_OF_SCIENCE_IN_NURSING_GRADUATES_IN_NURSING_COUNCIL_OF_KENYA_LICENSURE_EXAMINATIONS.

Smith, B. (2014). *Student nurse infection control: Survival guide* (Ser. 2010). Routledge.

Odonkor, S. T., & Frimpong, K. (2020). Burnout among healthcare professionals in Ghana: a critical assessment. *BioMed research international*, *2020*. https://doi.org/10.1155/2020/1614968.

Office of Program Consultation and Accreditation. (2018, September 28). Direct observation: What it means and what's required. Commission on Accreditation (CoA) Update. Retrieved from https://www.apa.org/ed/accreditation/newsletter/2018/09/direct-observation.

Open Resource for Nursing: Ernstmeyer, K., & Christman, E. (2023). Initiate IV Therapy. In Nursing Advanced Skills [Internet]. Chippewa Valley Technical College.

Raynak, A., Paquet, F., Marchionni, C., Lok, V., Gauthier, M., & Frati, (2020). Nurses' knowledge on routine care and maintenance of adult vascular access devices: A scoping review. Journal of Clinical Nursing, 29(21-22), 3905- 3921. ISBN-13: 9781734914160 (ebook).

Osório, N., Oliveira, V., Costa, M. I., Santos-Costa, P., Serambeque, B., Gama, F., ... & Salgueiro-Oliveira, A. (2023). Short peripheral venous catheters contamination and the dangers of bloodstream infection in Portugal: An analytic study. *Microorganisms*, *11*(3), 709. https://doi.org/10.3390/microorganisms11030709.

Osti, C., Khadka, M., Wosti, D., Gurung, G., & Zhao, Q. (2019). Knowledge and practice towards care and maintenance of peripheral intravenous cannula among nurses in Chitwan Medical College Teaching Hospital, Nepal. Nursing open, 6(3), 1006-1012. https://onlinelibrary.wiley.com/doi/abs/10.1002/nop2.288.

Privitera, D., Bassi, E., Airoldi, C., Capsoni, N., Innocenti, G., Santomauro, I., & Dal Molin, A. (2023).

Effectiveness of short peripheral intravenous catheter educational programmes to improve clinical outcomes protocol for a systematic review. MethodsX, 102352. https://doi.org/10.1016/j.mex.2023.102352.

Ray-Barruel, G., & Alexander, M. (2023). CE: Evidence-based practice for peripheral intravenous catheter management. AJN, American Journal of Nursing, 123(1), 32-37. https://doi.org/10.1097/01.NAJ.0000905568.37179.01.

Raynak, A., Paquet, F., Marchionni, C., Lok, V., Gauthier, M., & Frati, F. (2020). Nurses' knowledge on routine care and maintenance of adult vascular access devices: A scoping review. Journal of Clinical Nursing, 29(21-22), 3905-3921. https://doi.org/10.1111/jocn.15419.

Rezaee, N., Sartipi, M., Jahantigh, M., Pezaro, S., & Mardani-Hamooleh, M. (2025). Barriers to the prevention and control of healthcare-associated infections in public hospitals: a qualitative study of Sistan and Baluchistan province, Iran. *BMC nursing*, *24*(1), 972. https://doi.org/10.1186/s12912-025-03650-4.

Rodriguez-Calero, M. A., de Pedro-Gomez, J. E., Molero-Ballester, L. J., Fernandez-Fernandez, I., Matamalas-Massanet, C., Moreno-Mejias, L., ... & Morales-Asencio, J. M. (2020). Risk factors for difficult peripheral intravenous cannulation. The PIVV2 multicentre case-control study. *Journal of clinical medicine*, *9*(3), 799. https://doi.org/10.3390/jcm9030799.

SH, Sr & Rani, Dr. (2021). KNOWLEDGE AND PRACTICE ON IV CANNULATION AMONG NURSES. IDC International Journal. 8. 10.47211/idcij.2021.v08i01.008.

Shettigar, S., Aradhya, A. S., Ramappa, S., Reddy, V., & Venkatagiri, P. (2021). Reducing healthcare-associated infections by improving compliance to aseptic non-touch technique in intravenous line maintenance: a quality improvement approach. BMJ Open Quality, 10(Suppl 1), e001394. http://dx.doi.org/10.1136/bmjoq-2021-001394.

Welyczko, N. (2020). Peripheral intravenous cannulation: reducing pain and local complications. *British*

Journal of Nursing, *29*(8), S12-S19. https://doi.org/10.12968/bjon.2020.29.8.S12.

World Health Organization. (2023). *Global strategy on infection prevention and control*. https://www.who.int/publications/i/item/9789240080515.

Zingg, W., Barton, A., Bitmead, J., Eggimann, P., Pujol, M., Simon, A., & Tatzel, J. (2023). Best practice in the use of peripheral venous catheters: a scoping review and expert consensus. Infection prevention in practice, 5(2), 100271. https://doi.org/10.1016/S0924-8579(09)70565-5.

APPENDICES

Appendix I: consent explanation

I am a second-year masters student at the Masinde Muliro University of Science and Technology, where I am pursuing a master's degree in advanced practice nursing (medical-surgical nursing) at the college of health sciences.

Greetings, Participant

As part of the requirements for the master's degree in medical-surgical nursing, I plan to conduct a study on "Nurses' knowledge of evidence-based recommendations on the prevention of peripheral venous cannulae-related infections: a multicenter survey."

It is voluntary for you to participate in this study. In order to better understand how to provide nursing care that meets patients' needs and expectations, the information you submit will be used to investigate your perspectives and experiences with the profession. In the event that you consent to take part in this research, you will be required to answer a series of questions about your role as a patient in nursing care as well as your satisfaction, perceptions, expectations, and experiences. It will take about fifteen minutes, and you will be professionally guided through. You won't experience any pain or injury during this process, and there won't be any payment for taking part.

You won't write down any personal information because the data you submit will be kept private and anonymous. While taking part in research may result in a loss of privacy, we will do everything in our power to keep your information private. If you decide to stop participating in the study at any point, you will be able to do so without fear of prejudice or victimization in the treatments you receive afterwards.

Your involvement will be greatly valued. Please feel free to email doriskinya6@gmail.com or call 0711863222 to reach the principal investigator with any questions or requests for clarification. In addition, the Secretary of the Research and Ethics Committee

Thank you.

Doris Kinya Riungu (Principal Investigator) INFORMED CONSENT

I, …….. having read the consent explanation and explained to, do voluntarily agree to take part in this study on “Patients’ Perceptions Regarding nursing care at Ziwa and Turbo, Burnt forest, and Uasin Gishu Sub-county Hospitals on the …….. day of ……, 2017. I am also aware that I can withdraw from the study without losing any benefits or treatment.

Signed ……. Witness

……. Date …….

Appendix II: Questionnaire Please circle as appropriate Part 1: Demographic

1. Year of service:
   <5 years 1-5 years 5-10 years >10 years
2. Department
   Medical surgical
3. Educational level

Certicate diploma degree masters

4. Position
   Nursing officer III Nursing Officer II Nursing Officer I Senior Nursing Officer

Part 2: Knowledge on evidence-based guidelines for preventive interventions for peripheral intravenous cannulae –related infections			
Question	yes	no	I don't know
A cannula with a gauge 14G, 16G, 18G and 20G are suitable to apply for peripheral intravenous cannulation.			
The veins used for intravenous cannulation are typically found in the metacarpal, cephalic, and basilic regions of the right and left upper extremities.			
After insertion, the peripheral IV cannula needs to be taken out every 12 to 72 hours.			
According to UIC guidelines, an IV cannula can be used for 48 to 72 hours if there are no indications of a problem.			
The most recognisable infection associated with IV cannulation is plebitis.			
Will the state of the environment (such as cleanliness) affect the risk of infection associated with IV cannulation?			
Will infection occur if aseptic technique is maintained only during IV cannula insertion?· Hand hygiene before procedure IV insertion is important in order to prevent infection?			
It is recommended to wear non-sterile gloves when inserting an IV cannula.			
Prior to the insertion of the IV cannula, the insertion site must be prepared.			
An increase in cannulation attempts will raise the infection risk.			

Part 3: Clinical competence in inserting, removing, and caring for peripheral intravenous cannulae.			
Question	Always	Sometimes	Not at all
I always replace the IV cannula 72 hours after it is inserted.			

As soon as I noticed a phlebitis symptom, I switched the IV cannula to the unaffected area.			
I always secure the IV cannula using transparent dressing.			
I always include the date, time, location, size, change in the due date, and the name of the cannulated person.			
I use IV cannula administration sets within 72 hours.			
I am aware that IV cannulation can result in complications such as infiltration, phlebitis, and extravasation.			
I always prepare, insert, and remove IV cannulas using aseptic technique.			
I understand how crucial it is to prepare the skin before inserting the IV cannula.			
I am aware of the variables that affect the likelihood of contracting an infection.			
I always perform IV cannulation according to the instructions provided by my hospital.			

Appendix III: check list Peripheral intravenous cannulae insertion, care and removal.

Activity	Done	Not done
1. Ensure a PIC is indicated.		
2. Obtain a mobile sharps bin		
3. Obtain a procedural trolley.		
4. Clean the procedural trolley surface.		
5. wrote date, time of insertion		
6. wrote site of insertion of cannula		
7. Wrote due date for changing of cannula		
8. Collect all required equipment.		
9. Where possible, introduce yourself to the patient, ,		
10. Verify identity		
11. Explain the procedure and		
12. Obtain verbal consent.		
13. Check for allergies, e.g. to tape, iodine or chlorhexidine.		
14. Remove wrist and hand jewelry,		
15. Roll up long sleeves to the elbow.		
16. Perform hand hygiene.		
17. Open dressing/IV starter pack,		
18. Establishing aseptic field;		
19. Place sterile equipment onto field.		
20. Position patient to ensure best access to site.		
21. Ensure adequate lighting		
Position procedural trolley for easy access and the sharps bin to allow for immediate sharps disposal.		
Inspect and assess the site for the PIC (if the site is visibly dirty clean with soap and water prior to decontamination)		
24. Choose the type, size and length of the PIC.		
Place a tourniquet around the limb proximal to where the PIC is to be inserted.		
26. Inspect and assess the insertion site again.		
To further dilate the vein if required: . The patient can assist by clenching their fist, .		
28. Stroke or tap the vein with your fingers (only before skin disinfection) .		
29. Allow the arm to hang over the side of the bed.		
30. Apply a warm compress to the area before skin decontamination.		
31. Perform hand hygiene		
32. Don gloves.		

Thoroughly decontaminate skin with =0.5% chlorhexidine in 70% alcohol, swab with side-to-side or up and down motion with light friction; repeat with a second swab;		
34. Allow to air dry (allow at least 1 minute before insertion).		
35. Do not touch site once it has been prepared.		
In conscious patients, administer anaesthetic to the insertion site and wait for it to take effect.		
Using the thumb of the non-dominant hand stretch the skin distal to the vein in order to apply counter traction and steady the vein.		
Insert PIC according to the manufactures' guidelines. Be aware that each manufacturer has a slight variation for each PIC for insertion.		
39. Entry into the vein is signalled by a flashback of blood.		
40. Hold needle steady,		
41. flatten the cannula,		
42. advance 2-5 mm,		
43. Then further advance the cannula up the vein.		
44. Release tourniquet.		
Apply pressure to skin over tip of PIC to prevent blood spillage while needle is completely removed.		
46. Safely dispose of sharps.		
47. Attach capless valve.		
Apply transparent occlusive dressing to ensure secure fixation and visibility of site,		
49. Write date of insertion on dressing or apply PIC insertion sticker.		
50. Flush PIC with 10mL of 0.9% saline.		
Attach correctly labelled administration set if commencing continuous infusions.		
52. Dispose of equipment into waste containers,		
53. remove gloves;		
54. Perform hand hygiene.		
55. Clean the procedural trolley surface		
56. Perform hand hygiene.		
57. Document in patient's health record: date		
58. Document in patient's health record: time,		
59. Document in patient's health record; site of insertion;		
60. Document in patient's health record; person who performed insertion.		
If an inexperienced clinician has not inserted PIC after two attempts, assistance from an experienced clinician (where possible) should be sought or local escalation policy followed.		

Appendix IV: Approval Letter from Institutional Ethics Research Committee

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY
Tel: 056-31375
Fax: 056-30153
E-mail: directorrel@mmust.ac.ke
Website: www.mmust.ac.ke
P. O. Box 190
Kakamega
50100
Kenya

Institutional Ethics Review Committee (IERC)

MMU/COR: 403012(7) 12th October, 2017

Doris Kinya Riungu
Registration No. HNR/G/44/2015
Masinde Muliro University of Science and Technology
P. O. Box 3-30100
MOI TEACHING AND REFERRAL HOSPITAL

Dear Ms. Riungu,

RE: ETHICAL APPROVAL TO CONDUCT RESEARCH

The IERC received your proposal titled ***"Evaluation of Nurses Competence in the Prevention of Peripheral Venous Cannulae Related Infections"***. The IERC, MMUST chapter therefore grants ethical clearance for you to conduct your research as proposed. In case of any adverse reactions to the patients, please report to IERC, MMUST.

On behalf of IERC and the University Senate, receive my congratulations. We wish you success in your research endeavour.

Yours faithfully,

for Dr. Nguka Gordon
Chairman, Institutional Ethics Review Committee

Copy to:

- The Secretary, National Bio-Ethics Committee
- Vice Chancellor
- DVC (PR&I)
- DVC (A & F)
- DVC (A&SA)

Appendix V: Approval Letter from NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: 020-400 7000,
0713 788787,0735464245
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref No **NACOSTI/P/18/30556/21286** Date: **20th February, 2018**

Doris Kinya Riungu
Masinde Muliro University
of Science and Technology
P. O Box 190-50100
KAKAMEGA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Evaluation of nurse competence in the prevention of peripheral venous cannulae related infections"*** I am pleased to inform you that you have been authorized to undertake research in **Uasin-Gishu County** for the period ending **20th February, 2019.**

You are advised to report to **the County Commissioner, the County Director of Education and the County Director of Health Services, Uasin-Gishu County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GP Kalerwa
GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Uasin-Gishu County.

The County Director of Education
Uasin-Gishu County.

National Commission for Science, Technology and Innovation-NACOSTI, 2018 - certified