



SCHOOL OF NURSING

**PRACTICE LEVEL AND ASSOCIATED FACTORS TOWARDS
CENTRAL LINE CATHETER ASSOCIATED BLOOD STREAM
INFECTION PREVENTION PRACTICE AMONG NURSES IN
ICU OF PUBLIC HOSPITALS, ADDIS ABABA, ETHIOPIA, 2024**

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Practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in ICU of public hospitals, Addis Ababa, Ethiopia, 2024

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Abstract

Background: Central venous catheterization, involving inserting a catheter into a vein connected to the heart, is associated with significant morbidity and costs due to central line-associated bloodstream infections. These infections are a major health concern in intensive care units, causing high morbidity, mortality, and economic burden. This is especially true in Ethiopia, where inadequate nurse training and poor protocol adherence exacerbate the problem.

Methods: An institutional-based cross-sectional study was conducted among intensive care unit nurses in selected public hospitals in Addis Ababa, 2024. Hospitals were selected using simple random sampling, and 403 intensive care unit nurses working during the data collection period were included. Data were collected via a structured questionnaire and an observational checklist, then analyzed using SPSS version 26. Descriptive statistics summarized frequencies, percentages, and distributions used. To check model of fitness use Hosmer-Lemeshow bivariate and multivariable binary logistic regression analyses identified variables significantly associated with central line catheter prevention practices (p-value < 0.05).

Objective: To assess practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in ICU of public hospitals, Addis Ababa, Ethiopia, 2024.

Results: Of the 403 intensive care unit nurses approached, 386 participated, yielding a 95.8% response rate. The study revealed that 64.8% of nurses had poor central line catheter prevention practices, while only 35.2% demonstrated good practices. Factors significantly influencing central line catheter prevention practices included knowledge, work experience, educational status, nurse- to-patient ratio, in-service training, and availability of central line catheter guidelines. Nurses with good knowledge (AOR=4.323, 95% CI: 2.515-7.429) and those with a master's degree in critical care (AOR=3.625, 95% CI: 1.990-6.601) were more likely to practice effective central line catheter prevention.

Conclusion and Recommendation: Only 35.2% care of intensive care unit nurses in Addis Ababa practiced good central line catheter prevention. Key factors included knowledge, education, experience, nurse-to-patient ratio, training, and guidelines. Improving practices requires regular training, higher education, optimal nurse-to-patient ratios, clear guidelines, monitoring, and continuous learning. Addressing these areas can reduce infections and improve intensive care unit patient outcome.

Keywords: Critical care nurse, Central venous catheters, Infection control

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Abbreviations and acronyms

- AaBET-----Addis Ababa Burn, Emergency and Trauma
- AACHB-----Addis Ababa City Health Bureau
- BSC-----Bachelor of Sciences
- BSI-----Blood Stream Infection
- CCN----- Critical Care Nursing
- CDC----- Center of Disease Control
- CLABSI-----Central Line Associated Blood Stream Infection
- CRBSI-----Catheter Related Blood Stream Infection
- CVC----- Central Line Catheter
- FMOH-----Federal Ministry of Health
- HAI-----Hospital Acquire Infection
- HR-----Human Resource
- ICU-----Intensive Care Unit
- IV-----Inter venous line
- MSC-----Master of Sciences
- NICU-----Neonatal Intensive Care Unit
- PI-----Principal Investigation
- PICU-----Pediatric Intensive Care Unit
- SPSS-----Statistical Package For The Social Sciences
- St. Paul's-----Saint Paul's
- St. peter,s-----Saint peter,s

1. Introduction

1.1. Background

Central venous catheterization is the process of inserting a catheter directly into a vein that connects to the heart(1). It is a crucial component of essential support in intensive care units and the most often used catheters following peripheral venous catheters, which are acknowledged as one of most fundamental uses of contemporary clinical care(2).It is commonly used for administering medications that are insufficiently given orally or through a forearm cannula(1). It is also utilized in situations that need for critical care, like checking the heart's and veins' condition and providing hemodialysis when renal replacement therapy is required(3).In addition, enteral venues catheter allows for the monitoring of various procedures such as central venous pressure measurements and diagnostic testing(4).

Globally, approximately 60% of hospitalized patients in healthcare institutions require parenteral solutions through peripheral or central routes(5).Even though this device is extensively utilized in patients requiring highly complex care(6).Infections such as arise from failures, misunderstandings, and errors during patient care, and have the potential to worsen the patient's clinical condition. Consequently, they contribute to longer hospital stays, increased costs of medications and supplies, as well as occupying beds in medium and high complexity healthcare settings(5, 6).

Nurses must be well-educated on the indications, insertion techniques, maintenance procedures, and monitoring of central venous catheters to effectively prevent central line-associated bloodstream infections (CLABSI) (7).The application of central line bundles has been shown to reduce the incidence of CLABSI worldwide. The use of insertion and maintenance bundles in an ICU setting reduced the rate of CLABSI by 12.2 percent, according to a recent multicenter trial published in 2017 (8).

Nurses are very interested to decrease the frequency of these illnesses in order to enhance patient outcomes and save healthcare expenditures(9).

To involving health care providers who order Central venous catheter (CVC) insertion and removal, intravascular catheter insertion and maintenance personnel, infection control staff, healthcare managers, including individuals who deal resources, and patients who are proficient of supplementary in the care of their catheters(7).

Critical care nurses play a vital role in the prevention of CLABSI as they are responsible for daily care and prevention of central venous catheters(2, 10). For daily care and prevention , nurses must ensure that proper hand hygiene practices are followed because hands are mainly the mode of pathogen transmission(11). They are also responsible for catheter dressing changes, daily site assessments for signs of infection, intravenous tubing changes, flushing the lumen with saline before and after given medication, giving anticoagulant and disinfection of catheter hubs as well as daily patient bathing with chlorhexidine(10).

The Aim of this study is to assess practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in to apply central line catheter prevention to reduce catheter site infection(12).And also apply central line catheter practice and prevention method of CLABSI by understanding extremely crucial areas to reduce the rate of morbidity, mortality and expensive complications connected to catheter-related infections(7, 8).

1.2. Statement of the Problem

Central line-associated bloodstream infections (CLABSI) are a major health concern worldwide, particularly in Intensive Care Units (ICUs), where patients are at a higher risk due to the invasive nature of central venous catheters (CVCs). These infections lead to significant morbidity, mortality, and economic burden, which underscores the critical importance of proper management practices by ICU nurses(5).

Globally, the incidence of CLABSI remains high, despite advancements in medical technology and infection control protocols. In the Bagdad , approximately 250,000 CLABSI occur annually, with mortality rates reaching up to 25%(1) .These infections not only increase the length of hospital stays but also add billions of dollars in healthcare costs each year(2).The Centers for Disease Control and Prevention (CDC) have established guidelines to prevent CLABSI, but adherence to these protocols varies significantly among healthcare facilities(13).

In Europe, the issue persists. A study in Spain indicated that CLABSI are among the most dangerous hospital-acquired infections, resulting in prolonged hospital stays, increased morbidity, and higher healthcare costs(14). In the Netherlands, research highlighted severe outcomes for pediatric oncology patients with CVCs, where 73% of those with prolonged catheter use developed severe sepsis, necessitating intensive care (15).

Middle Eastern countries also face challenges in controlling CLABSI. In Saudi Arabia, studies revealed that despite high levels of awareness among ICU nurse, inconsistent adherence to central line maintenance practices led to elevated infection rates(8). Similarly, in Poland , significant gaps in nurses' knowledge and compliance with prevention guidelines were linked to higher CLABSI rates(11).

In Africa, the problem is exacerbated by limited resources and inadequate training. In Nigeria, a study reported a CLABSI rate of 57.1%, highlighting the impact of high nurse workloads and poor adherence to infection prevention protocols(16).

South Africa has also reported high CLABSI rates in ICUs, contributing to increased patient morbidity and mortality. A study emphasized the need for continuous education and adherence to evidence-based guidelines to mitigate these infections(10). It highlighted that inadequate training

and resources are significant barriers to effective infection control practices. In Egypt, a study found high infection rates in critical care units, with significant associations between infection rates and barriers such as heavy workloads and insufficient precautionary measures(3).

Ethiopia faces severe challenges in managing CLABSI due to resource limitations and gaps in nurse training. Research conducted in Addis Ababa's public hospitals indicated that patients with central vascular catheters were 3.48 times more likely to acquire healthcare-associated infections (HAIs). Among the 74 catheterized patients studied, 73% developed HAIs, illustrating the high prevalence of these infections(17).

The proposed research actions aim to fill the existing gaps in practice among ICU nurses in Ethiopia's public hospitals. By improving nurses' practices and adherence to infection prevention protocols, it is possible to significantly reduce the incidence of CLABSI, thereby improving patient outcomes and reducing healthcare costs.

1.3. Significant of the study

This research on central line catheter care in intensive care units is importance to several key stakeholders:

For patients, it will be significantly reducing CLABSI rates directly lowers morbidity and mortality. This may be leads to faster recoveries, shorter ICU and hospital stays, and lessens the overall burden on healthcare resources of the individual and the organization.

Health Institutions and Healthcare Providers: the study provide critical insights into effective practices for managing central line catheters and preventing associated infections. This information help health institutions and healthcare providers adopt evidence-based protocols, ensuring more consistent and effective infection control across ICUs.

Quality Improvement: Identifying successful strategies and areas needing improvement support hospitals in refining their infection prevention protocols, thereby enhancing overall patient safety and care quality.

Researchers and Academic Institutions: it will provide a valuable foundation for future studies and encourage further academic exploration into central line practice and infection prevention.

2. Literature review

2.1. Over view of central line catheter infection

Globally, ICU nurses' knowledge and adherence to guidelines for preventing CLABSI vary significantly. In a comprehensive study conducted in United States of America, factors associated with recurrence and mortality in CLABSI were analyzed, emphasizing the importance of stringent infection control measures and ongoing education (18). Similarly, study illustrated in Australia highlighted the unique challenges and required meticulous care in managing central venous catheters in infants, underlining the importance of specialized training (4).

Central line-associated bloodstream infections (CLABSI) are the leading cause of preventable hospital-associated infections. Study in United States intensive care units (ICU) alone, approximately 80,000 CLABSI cases occur each year, causing 28,000 deaths annually (14).

In the United States, a study conducted in a large acute care hospital demonstrated a significant reduction in CLABSI rates following the implementation of a comprehensive central line insertion and maintenance bundle (19). The incidence rate dropped from 2.0 to 0.5 infections per 1,000 central line days, highlighting the effectiveness of standardized infection prevention measures (20). Similarly, in European countries, the prevalence of CLABSI can range widely. For instance, certain countries report incidences as high as 2.5 infections per 1,000 central line days in ICU settings, indicating disparities in the implementation of infection control practices and resource allocation (4).

Study conducted in Netherlands, in PICU delaying the decision to remove the CVC may have a major impact on the children's clinical status, increasing the risk of severe sepsis that could need hospitalization in the PICU or even result in death (15).

Research conducted in Poland, patients with CVCs are more likely to have blood infections, which are major causes of morbidity, mortality, and high medical costs. An estimated 0.5 million patients get nosocomial infections each year, which could equate to 50,000 patients getting infections from intravenous and vascular therapy each year (21).

In Africa, the situation is compounded by limited healthcare resources, insufficient training, and inconsistent implementation of infection control measures. Studies in various African countries illustrate the high prevalence of CLABSI in ICU settings. In Nigeria, a study revealed a CLABSI rate of 5.1 per 1,000 central line days, primarily due to a lack of awareness and practice to central venous catheter care bundles among critical care providers(16).In Sudan demonstrated that structured education programs significantly enhanced nurses' knowledge and practices regarding CLABSI prevention (22).

A study in Addis Ababa reported a high prevalence of healthcare-associated infections, including a CLABSI rate of 7.4 per 1,000 central line days in ICUs of selected public hospitals. Contributing factors included poor adherence to infection prevention protocols, inadequate healthcare worker training, and lack of essential resources like sterile supplies and disinfectants(17).

2.2. Knowledge factor for practice of nurse on CLC prevention

Research conducted in Saudi Arabia revealed that nurses demonstrated higher compliance with hand hygiene practices compared to physicians (23).The success of CLABSI prevention largely depends on nurse compliance, primarily because it allows for proper central line practice(8, 23).

However, a study conducted in Italy found that only 22.5% of nurses practiced correct hand hygiene in the ICU before central venous catheter insertion (24). Similarly, research in Egypt indicated that implementing a 5-minute hand hygiene protocol before and after evaluating insertion sites, manipulating the line or ports, and changing dressings is crucial for preventing CLABSI (3).

In Saudi Arabia, about 65% of nurse professionals endorsed the use of chlorhexidine as an improved antiseptic agent over iodine (8). Employing the highest standard of aseptic techniques and protective barrier precautions is essential. For instance, a comparable study in the United States recommended preparing the skin with 2% chlorhexidine gluconate prior to catheter insertion(20). Conversely, 15% of participants in a Chinese study reported not using 2% chlorhexidine gluconate before catheter insertion (25). In Egypt, only 27% of the sample utilized chlorhexidine 2% to clean the access port or needleless connections (3).

Post-insertion nursing care includes dressing changes, drawing blood, administering medication, and intravenous antibiotic prophylaxis (26).Patients with bleeding, seeping, or diaphoresis around

the insertion sites should be treated with sterile gauze bandages once the situation stabilize(20). A dry insertion site is critical for inhibiting CLABSI formation as it reduces skin colonization (27). In Saudi Arabia, 65.5% of participants reported following evidence-based CVC maintenance procedures (28). Evidence-based guidelines recommend changing sterile gauze dressings every 2 days and transparent dressings weekly (29). Transparent dressings allow nurses to examine the catheter site for signs of infection (27). In a prospective study conducted in Poland, the majority of nurses reported changing dry, clean, transparent dressings every seven days, while 87% believed dry, clean gauze dressings should be changed every two days (21).

Central line catheter insertion requires the use of sterile gloves and maintaining aseptic technique (25). A study at Mansoura University in Egypt found that nearly half of the nurses adhered to maximal barrier precautions, including hand washing, donning sterile gloves, and draping around the insertion site(30).

The development of CLABSI is linked to the frequency of intravenous fluid administration set changes. For blood and fat emulsions, change sets 24 hours after infusion. For propofol, change sets every 12 hours or with each vial. For antibiotics and inotropes, change sets every 72 hours(20).

2.3. Institutional related factors

The availability of guidelines significantly influences the prevention of central line-associated bloodstream infections (CLABSI). Study conducted in Bangladesh that the implementation of standardized guidelines in Baghdad Teaching Hospitals led to improved knowledge among nurses, thereby enhancing infection control practices(1). Similarly, study conducted in Austria line tertiary hospital guidelines are widely acknowledged as benchmarks for infection prevention, emphasizing the necessity of evidence-based protocols(31).

Resource availability is crucial for effective CLC infection prevention. A study illustrated in Turkey found that adequate resources, including sterilization equipment and disposable supplies, directly impacted nurses' ability to adhere to infection control measures(2).

The nurse-to-patient ratio is a critical factor in preventing CLC infections. Study done in Jordan 70 % of nurses working with a lower nurse-patient ratio had higher compliance scores (32). Other qualitative study conducted in Korean that lower nurse-to-patient ratios were associated with better

patient outcomes, including reduced infection rates(33).Other similar study conducted in Egypt's on effect nursing performance toward central line, such as shortage in nursing staff number and patient outcomes in critical care populations, including death, adverse events, complications(3).

Furthermore, research in Egypt showed a statistically significant difference between years of nurse experience in the ICU and total practice scores(3) .A study in Southern Italy corroborated that younger nurses are more likely to benefit from university education and adhere to proper skin antiseptic and aseptic procedures when dressing catheter insertion sites(24).In Alshaab Teaching Hospital in Sudan, most participants had a BSc degree and more than a year of ICU experience, which increased their knowledge of care (31).Similarly, at Aldammam Teaching Hospital in Saudi Arabia, nurses with 5–9 years of experience showed increased knowledge of care(34).A fundamental disparity exists in ICU nurses' knowledge and practice regarding CVC care in Chinese hospitals (25) . Knowledge about current practices empowers critical care nurses and boosts their confidence in performing clinical skills, increasing compliance with best practices(32).

In-service training programs are essential for updating nurses' knowledge and skills regarding CLC infection prevention. Study conducted in Pakistan showed that educational interventions significantly improved nurses' knowledge and adherence to infection control protocols in intensive care units(12).

Hospital protocols that align with international standards are vital for preventing CLABSI. Study revel in USA advocated for a tiered approach to infection prevention, which includes stringent protocols for central line care (35).

Regular monitoring and evaluation of CLC practices are crucial for ensuring adherence to infection control measures. Research conducted in Saudi Arabia found that continuous audits and feedback in hospitals led to improved compliance with central line care standards(8).

2.4. Conceptual frame work

This conceptual framework is Adapted from different literature. This framework conceptualizes central line catheter prevention practice as the result of interactions between various factors. In this study, this conceptual framework looks at the relationship between dependent and independent variable.

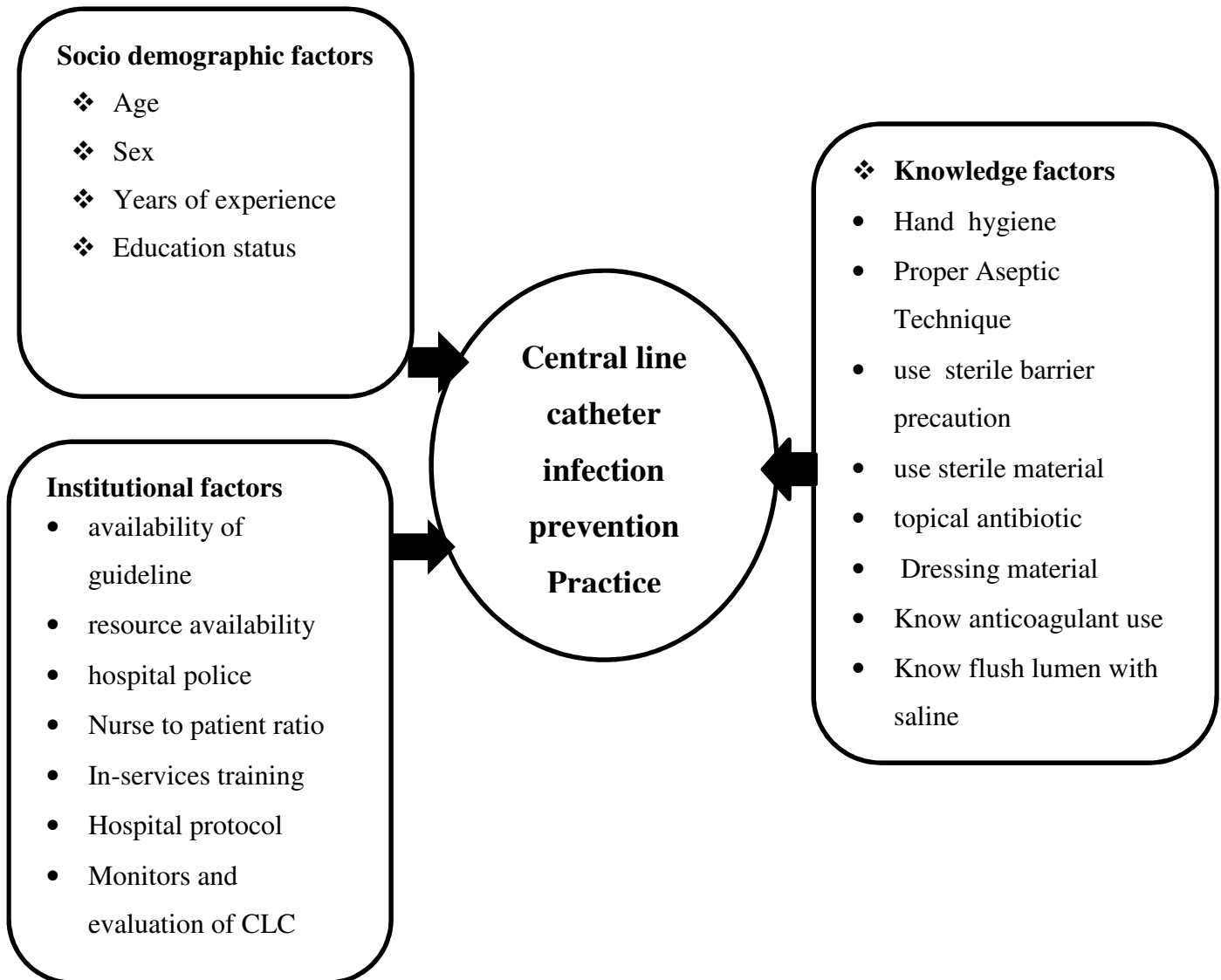


Figure 1: diagrammatic representation of a conceptual framework, to shown the relationship between independent variables and outcome variables in public hospital Addis Ababa, 2024 and adapted from (10, 28, 29, 36, 37).

3. Objectives

3.1. General objectives

- ❖ To assess practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in ICU of public hospitals, Addis Ababa, Ethiopia, 2024.

3.2. Specific objectives

- To determine practice level of nurses towards prevention of central line catheter infections in intensive care units of public hospitals in Addis Ababa, Ethiopia 2024.
- To identify factors associated with the practice of nurses towards prevention of central line catheter infections in intensive care units of public hospitals in Addis Ababa, Ethiopia, 2024.

4. Methods and materials

4.1. Study setting

According to the 2021 census, Addis Ababa has an estimated population of 5,006,000 and covers an area of 527 square kilometers(37). The city is home to thirteen public hospitals, five of which are under the control of the Federal Ministry of Health (FMOH), two of which are under managed in Addis Ababa government hospital, while the remaining is managed by the Addis Ababa City Health Bureau (AACHB). Six of these hospitals St. Paul Hospital Millennium Medical College (SPHMMC), Blake Lion Hospital, St.Peter's Specialized Hospital, AaBET Hospital, Menilik II Referral Hospital and Yikatete 12 Hospital have been selected randomly. These hospitals play a crucial role in providing critical care services not only for Addis Ababa residents but also for the entire region, as they receive referral cases from their catchment areas.

SPHMMC, located in the Gulele sub-city, is one of the largest public hospitals. Established in 1968, it is governed by a board under the Federal Ministry of Health. According to the college's website, SPHMMC has more than 2,800 clinical and non-clinical staff, among this more than 125 of nurse's work in ICU. The hospital has 700 beds and serves an average of 1,200 emergency and outpatient clients daily.

Blake Lion Hospital, a tertiary hospital in the country, has an inpatient capacity of over 800 beds and more than 98 ICU nurses work in the total of 1300 staff nurses.

St. Peter Specialized Hospital, there is 49 ICU nurses from the total of 267 staff nurses and it has 271 beds, it is a prominent tuberculosis hospital in Ethiopia and is known for its services related to cardiac diseases.

Menilik II Referral Hospital, the first established hospital in the healthcare development history of Ethiopia, is the sole specialized eye care service provider for patients in the country, there is 45 ICU nurses from the total of 376 nurses. Yikatete 12 General Hospital, with 272 beds and 48 of the total 480 staff nurses work in ICU , and AaBET Hospital, an emergency dedicated center for trauma care, orthopedics, neurosurgery, general surgery, and plastic surgery, with 190 beds and from the total of 190 staff nurses 45 of them work in ICU.

4.2. Study period

The study was conducted between May 8 to June 11, 2024 at selected public hospitals in Addis Ababa, Ethiopia.

4.3. Study design

Institutional based cross-sectional study was conducted

4.4. Population

4.4.1. Source population

All nurses who work in ICU of public hospitals in Addis Ababa, Ethiopia, 2024

4.4.2. Study population

All nurses who work in ICU of selected hospitals Addis Ababa, Ethiopia, 2024.

4.4.3. Sampling unit

Randomly selected of individual nurses in ICU of selected public hospital in Addis Ababa, 2024

4.5. Eligibility Criteria

4.5.1. Inclusion criteria

Nurses working in ICU units with at least six months of experience, who were available and willing to participate during the data collection period, were included in the study.

4.5.2. Exclusion criteria

Nurses who were give free serves, on annual leave, or lacked a valid license during the data collection period were excluded.

4.6. Sample size determination

The sample size was calculated using a single population proportion formula. Below were the lists of assumptions and formula that were considered in calculating the sample. The minimal sample size was calculated using 50% response rate.

$$n = \frac{(Z_{\alpha/2})^2 P (1- P)}{d^2} = \frac{(1.96)^2 0.5(1-0.5)}{(0.05)^2} = 384$$

Where, n= Sample size to be determined

$Z_{\frac{\alpha}{2}}$ = Level of statistical significance at 95% confidence level =1.96

P= since 50% (0.5) reflects the maximum amount of variability that may be anticipated in the population, it is customary to use this value as the event probability when calculating sample sizes. Obtaining the biggest sample size necessary for the chosen confidence level and margin of error by estimating p in the sample size formula to be 0.5 margin of error at 5 % (0.05)

By using single population proportion formula and the above assumptions the sample size becomes 384. By considering 5% non-response rate the final sample size becomes 403. Therefore 403 sample were enrolled to conduct this study.

4.7. Sampling procedure

The study focused on nurses working in the Intensive Care Units (ICUs) of public hospitals in Addis Ababa. Out of the 13 public hospitals, 13 provide ICU services. For this research, Black Lion Specialized Hospital, St. Peter's Specialized Hospital, St. Paul's Hospital Millennium Medical College, Yikatete 12 Hospital, Menilik II Referral Hospital, and AaBET Hospital were selected using random sampling methods.

The total number of ICU nurses across these selected hospitals was 410, with the breakdown as follows: 98 nurses at Black Lion Specialized Hospital, 49 nurses at St. Peter's Specialized Hospital, 125 nurses at St. Paul's Hospital Millennium Medical College, 48 nurses at Yikatete 12 Hospital, 45 nurses at Menilik II Referral Hospital, and 45 nurses at AaBET Hospital. Given that the study population (410 nurses) was very close to the calculated sample size (403 nurses), it was to apply probability random sampling methods. Consequently, 403 ICU nurses who met the inclusion criteria and were present during the data collection period were included in the study, ensuring that every eligible nurse had an equal opportunity to participate.

The data collection process involved distributing self-administration questionnaire to gather socio-demographic data, institutional factors, and knowledge-related factors. Additionally, observations checklist of nurses performing interventions related to central line catheter care were conducted.

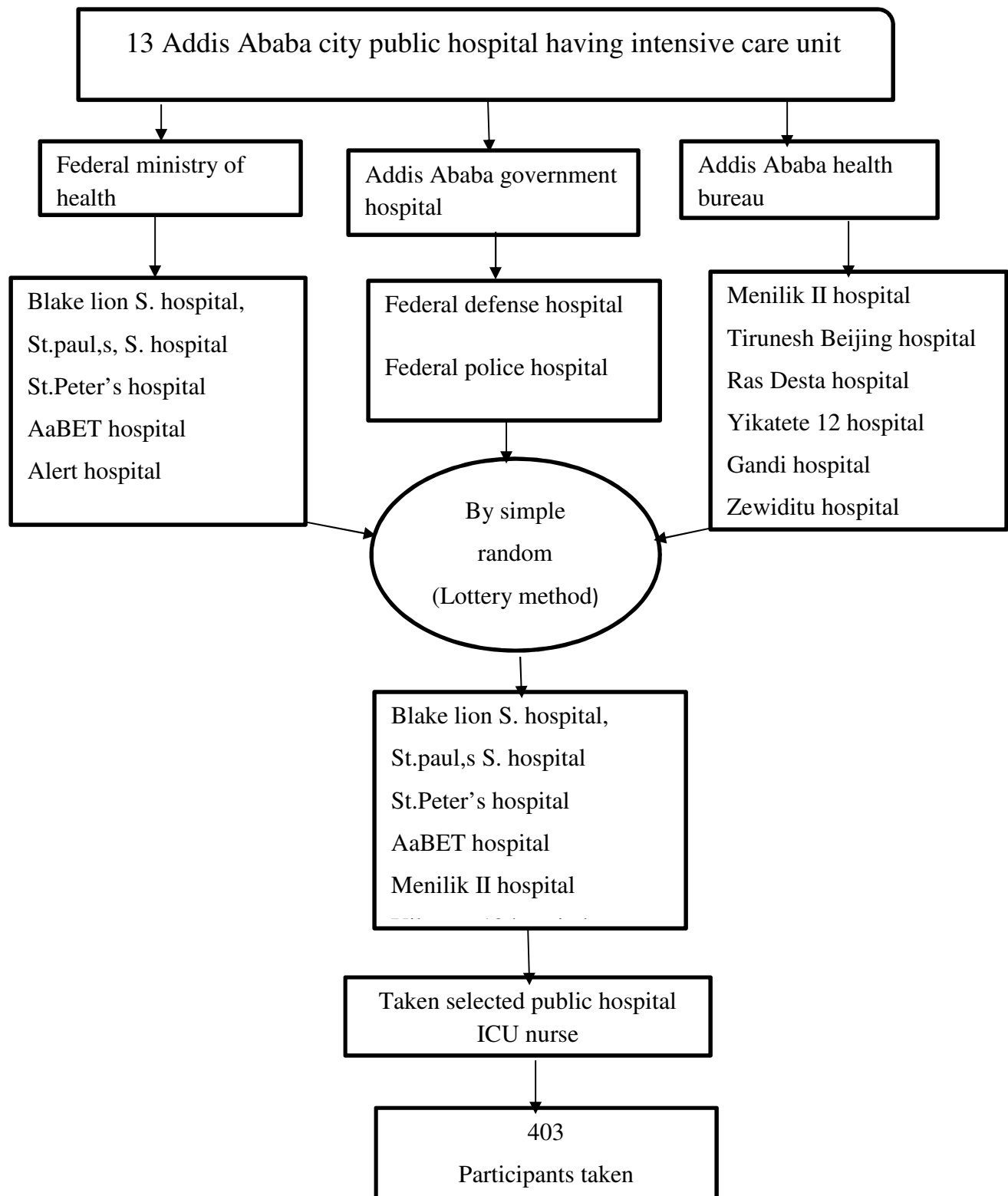


Figure 2: Schematic presentation of sampling procedure of selected public hospital Addis Ababa, Ethiopia ,2024 (3, 22)

4.8. Study Variables

4.8.1. *Dependent variable*

Central line catheter infection prevention practice

4.8.2. *Independent variables*

➤ **Socio-demographic factors**

- Age
- Sex
- Education status
- Experience

➤ **Knowledge factor**

- Hand hygiene
- Proper Aseptic Technique
- Use sterile barrier precaution
- Use sterile material
- Topical antibiotic
- Dressing material
- Anticoagulant use
- Know flush lumen with saline

➤ **Institutional factors**

- In-serves training
- Availability of guidelines
- Resource availability,
- Hospital police,
- CLC monitors and evaluation,
- Nurse to patient ratio

4.9. Operational definitions

Good knowledge: In this study good knowledge nurse means those study participants who asses a total sum score of knowledge questionnaire ,which $\geq 77\%$ on the knowledge assessment questions consider as good knowledge (26).

Poor knowledge: In this study Poor knowledge nurse means those study participants who asses a total sum score of knowledge questionnaire ,which $< 77\%$ on the knowledge assessment questions consider as poor knowledge (30).

Practice overall: - Dichotomized into good practice and Poor practice categories. Participants in this study were classified as:

Good practice nurses: In this study good practice nurse means those study participants who asses a total sum score of practice questionnaire $\geq 76\%$ on the practice related questions consider as good practice (26, 30).

Poor practice nurses: In this study Poor practice nurse means those study participants who asses a total sum score of practice $< 76\%$ on the practice related questions consider as poor practice (26).

Central Line Associated-Bloodstream Infections (CLABSIs): In this research CLABSIs means a Laboratory-confirmed bloodstream infection not related to an infection at another site that develops within 48 hours of central line placement

4.10. Data Collection tool and techniques

To ensure comprehensive data collection and validation for assessing the knowledge and practices level of nurses on central line catheter prevention, a structured methodology was employed. Initially, the questions were tested for reliability by administering the same set of questions to the same group of participants on two different occasions. This step, known as test-retest reliability, aimed to ensure consistency in responses. Following this, the questions underwent expert validation. Research academically and experts in clinical setting in ICU reviewed the questions to ensure they adequately covered the relevant aspects of central line catheter prevention practices, thereby establishing content validity. To mitigate the potential Hawthorne effect, the study participants were provided informed consent about the overall study objectives and

procedures. Participants were informed that the study involved a self-administered questionnaire component. However, the details about the hidden observational assessment of their practices were not disclosed to the participants. This approach was taken to obtain a more authentic representation of the participants' real-world practices, without the participants altering their behavior due to the awareness of being observed. Knowledge assessment questionnaire part consists of 10 questions. Scoring system: 1 (yes) and 0 (no). The total scores were 10: Poor knowledge score (<7.7) and good knowledge score (≥ 7.7). Practice observational checklist part consists of 21 questions. Scoring system: 1 (correct) practice and 0 (incorrect) or not properly done the practice. The total scores were 21: poor practice (<16) and good practice (≥ 16)(26, 30). The questionnaire were adapted from other similar studies and bundle of CDC checklist prepared(13).

Four BSC ICU trained nurses were obtain the information by using predesigned self ademinseterative and observational checklist questionnaire during the working hours (from eight in the morning till five in the afternoon). Two MSc critical care nurses were supervise the data collection process closely and they were followed by the principal investigator. The process were continued until the required number of samples were obtained and data was taken once from the individual Participants .All data collectors and a super visors were given one day training how to collect the exact data. The roster of nurses currently employed in the ICU department at designated public hospitals was compiled, and information was gathered in accordance with the schedule of each hospital's nursing program. Each nurse was assigned a numerical code during data collection to prevent duplicate responses.

4.11. Data quality control

To keep data quality, a range of mechanisms were employed. One day of training was given for data collectors and supervisors on the objective and relevance of the study, how to gather the appropriate information, procedures of data collection techniques, Inclusion/exclusion criteria, and the whole contents of the questionnaire. The checklists were collected from data collectors each day and checked by the principal investigator for any errors. Then appropriate measures were taken accordingly. Through the course of data collection, the data collectors were supervised and there were regular phone contacts between principal investigator, data collectors, and supervisors to discuss and correct problem which rise during the data collection period. Pretest were done at Rass Desta hospital (5% of the total sample and they are excluded from main study) to test the

feasibility, objectivity and applicability of the data collection tools and possible corrections to questionnaire were made by Calculate Cronbach's alpha (0.86) .The collected data was first check for completeness and edit every day after data collection by the principal investigator and supervisor. Then, data were filled by the data collectors using kobo toolbox collect software with four data collectors independently and consistency between the four data sets were checked. Then, exported to SPSS version 26 for data processing and analysis.

4.12. Data processing and analysis

The data was filled by the data collectors using kobo toolbox collect software and was exported to SPSS version 26 for data processing and analysis. During the analysis and description of the study, variables were identified using frequency tables, proportions, percentages, graphs, and numerical summary measures. Association between each independent and dependent variables were assessed by using binary logistic regression. The first association between each independent variable and dependent variable were assessed in bivariate analysis. Then, those independent variables with P-value <0.2 were transported to multivariate logistic regression to control the confounders. Hosmer-Lemeshow goodness-of-fit test was used to check the model fitness and Multicollinearity were assessed using the variance inflation factor. A P-value of <0.05 in the multivariate analysis were used as a criterion for the statistically significant association. The strength of the association were measured using the Odds ratio with corresponding 95% confidence intervals (CI).

4.13. Ethical Consideration

Ethical clearance and an official letter were obtained from the institutional review board at Ref. No PM23/1149 of St. Paul's Hospital Millennium Medical College and Addis Ababa health bureau to get permission to conduct the study. Then deliver to six selected hospital. Participants were informed about the potential risk and benefit of the research and its findings, preceding the data collection. They were informed about the confidentiality of the information they give and written consent were obtained from each participant immediately. The participants were not require writing their names on the questionnaires. The respondents were also notifying that they have the right to refuse or terminate at any point of the questioner.

4.14. Dissemination Plan

The final report of this thesis will be presented and submit to St. Paul's Hospital Millennium Medical College. The result of the study will be disseminate to the Federal Minister of Health, Addis Ababa public health research and emergency management core processes, and Addis Ababa public hospitals .The result also use and communicate to local health planners and other relevant stakeholders to enable them to consider recommendations during their planning process. Finally, the soft and hard copy is accessible thought the college library portal and attempt made to publish in national or international journals.

5. Result

5.1. Socio demographic characteristics of the Participants

The following table (1) shows the demographic characteristics of the study participants in terms of frequency and percentages. Three hundred eighty six (386) study participants included from the total of 403 sample, in this study with the response rate of 95.8%. More than half of study participants were females 213(55.2%). Most of the study participants 313(81.1%) belonged to the age group of 26 to 33 years, followed by 13.5% 18- 25 years and 34 to 41 years were 5.4%. Regarding educational status of the nurses 281(72.8%) were BSC nurse and 105 (27.2 %) were MSC nurse critical specialty.

Concerning on work experience majority 170(44%) of the study participants had 5-10 years' work experience, followed by less than 5 years were 117(30.3%). The findings revealed that the majority of the participants 117 (30.3%) were employed at SPHMMC hospital. Balk Lion hospital accounted for 94 (24.4%) of the workforce. St. Peter hospital, Menilik II hospital, Yikatete 12 hospital, and AaBET hospital had frequencies of 42 (10.9%), 46 (11.9%), 43 (11.1%), and 44 (11.4%) respectively (table 1).

Table 1: Socio demographic characteristics in practice level of nurses and associated factors related to the prevention of central line catheter infections in intensive care units in selected hospital Addis Ababa, Ethiopia 2024,(N=386)

Variable name	Category	Frequency	Percent
Sex	Male	173	44.8
	Female	213	55.2
Age	18-25 year	52	13.5
	26-33 year	313	81.1
	34-41 year	21	5.4

educational level	BSC nurse	281	72.8
	MSC nurse critical	105	27.2
Work experience	6 month-5 year	117	30.3
	6-10year	170	44
	11-15year	46	11.9
	>15 year	53	13.7
Working area	SPHMMC hospital	117	30.3
	Balk lion hospital	94	24.4
	St. Peter hospital	42	10.9
	Menilik II hospital	46	11.9
	Yikatete 12 hospital	43	11.1
	AaBET hospital	44	11.4

Regarding to nurses currently working unit majority of nurses working in adult ICU 282 (73.1%), followed by PICU 88(22.8%) and the remained were NICU, surgical and medical ICU (1.3%, 2.1% and 0.8%) respectively(figure 3).

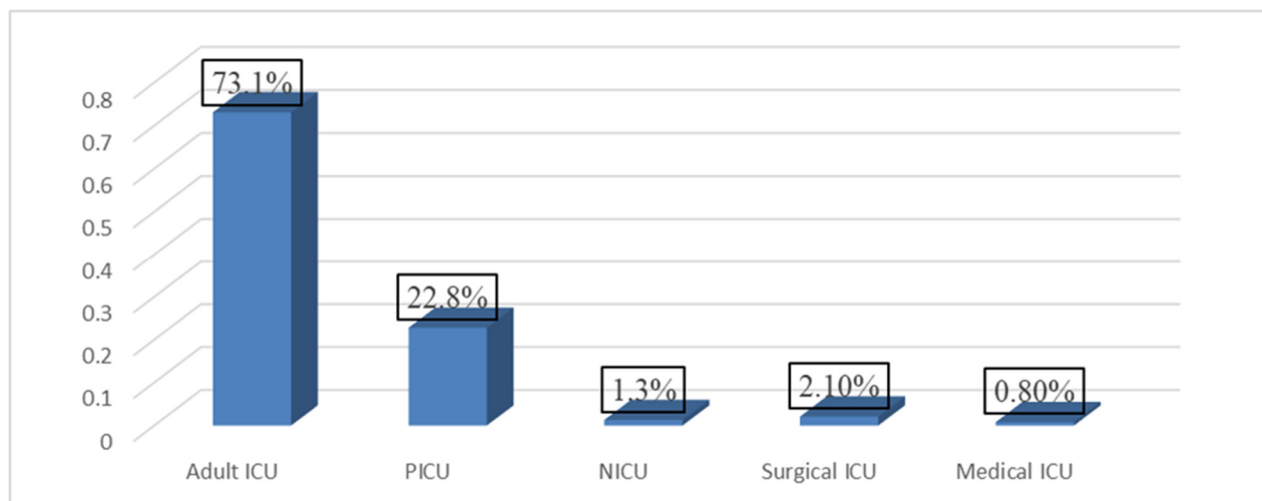


Figure 3: ICU nurse currently working unit in public hospital, Addis Ababa, Ethiopia, 2024

5.2. Institutional factors of central line catheter prevention practice

A majority of the nurses, 57% manage a 1:2 nurse-to-patient ratio, indicating that each nurse is responsible for two patients. A smaller proportion 116(43%), of the nurses manage a 1:1 nurse-to-patient ratio, where each nurse is dedicated to one patient. This lower ratio likely allows for more focused and detailed patient care. A majority 217(56.2%), of the nurses have not received training on CLC prevention ,as untrained nurses might be less familiar with best practices and the latest guidelines. A significant 216(56%) of the nurses do not have access to a CLC guideline. This could contribute to variability in care practices and potentially higher rates of central line-associated infections, as nurses might rely on memory or inconsistent practices rather than a standardized protocol. Finally about 205(53.1%) of the nurses engage in daily monitoring and evaluation of CLCs .This indicates that just over half of the nursing staff are involved in proactive surveillance practices . The study found that 46.1% of nurses had adequate resources, while 53.9% lacked them. Additionally, only 17.4% of nurses reported having supportive hospital policies, whereas 82.6% did not. These findings highlight the critical need for sufficient resources and robust policies to improve infection prevention practices (table 2).

Table 2: Institutional factors of central line catheter practices prevention in intensive care units in selected hospitals in Addis Ababa, Ethiopia, 2024 (N=386)

Factor	Category	Number (N)	Percentage (%)
Nurse to patient ratio	1:2	220	57
	1:1	166	43
Training taken	Yes	169	43.8
	No	217	56.2
Availability of CLC guideline	Yes	170	44
	No	216	56
	Yes	205	53.1

Daily monitoring and evaluation of CLC	No	181	46.9
Resource availability	Yes	178	46.1
	No	208	53.9
Hospital police	Yes	67	17.4
	No	319	82.6

5.3. Knowledge factors of ICU nurses on central line catheter prevention practice

A research study was conducted to evaluate the knowledge level of nurses regarding the prevention practices of central line catheter (CLC) associated infections. Knowledge was quantified using a scoring system, where the maximum possible score was 10. Nurses who achieved total sum score of 7.7 or higher were classified as having good knowledge in this study.

The study involved 386 nurse respondents. To assess their knowledge, they were asked to answer 10 specific questions related to CLC prevention practices. Table 3: in the study presents the detailed results of these questions, showing that the percentage of correct responses for individual questions varied between 38.1% and 76.9%. This range indicates variability in the knowledge levels across different aspects of CLC prevention. Out of the total respondents, only 183 nurses (47.4%) managed to score above the threshold of 7.7. This finding suggests that less than half of the participating nurses possess an adequate level of knowledge regarding the best practices for preventing central line catheter associated infections (figure 4). The results from Table 3: emphasize the need for targeted interventions to address knowledge gaps and reinforce best practices among nurses -associated infections.

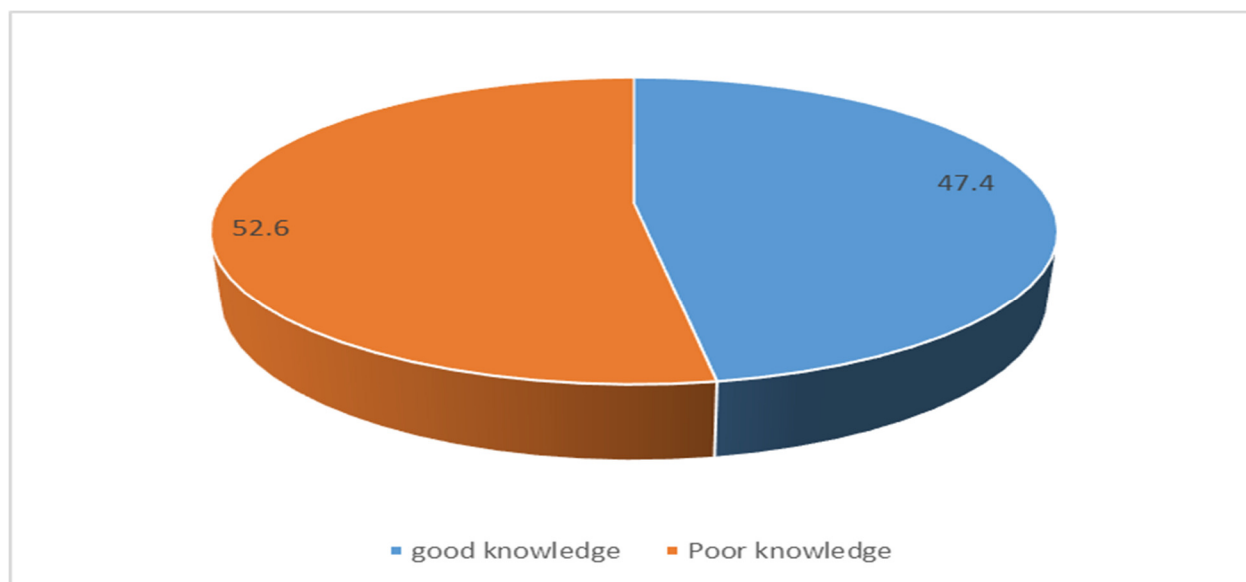


Figure 4: knowledge of nurse towards prevention of central line catheter in ICU, selected public hospitals in Addis Ababa, Ethiopia, 2024

Only 38.1 % of nurses indicated that know about the guidelines of central line catheter correctly. After giving medication or liquids, 55.7% of nurses knowing successfully flush the lumen with regular saline. Seventy-two percent of nurses correctly wrap the catheter site with sterile gauze or sterile transparent semipermeable bandage. Before correctly administering medication or liquids, 50.8% of the needleless connectors are disinfected.

Only 49.7 %ICU nurse correctly answered use topical antibiotic ointment on catheter insertion site. Around 54.1% of the nurses correctly answered that when blood, blood products, or fat emulsions were given through a CVC can be replaced the tube based on the standard, it is recommended that the drug delivery device (the IV administration sets) should be replaced every 72 hours. Only 42.7 % of participants were correctly answered disinfect with hydrogen peroxide the catheter insertion site properly. Finally, 47.7% correctly respond use routinely anticoagulants medication properly (table 3).

Table 3: Knowledge factors on practice of central line catheter prevention in ICU nurses in Selected hospital Addis Ababa, Ethiopia 2024 (N=386)

Questioners	Yes (%)	No (%)
Did you know about the guidelines of practice in central line catheter?	38.1	61.9
Did you flush the lumen with normal saline after the administration of medication or fluid?	55.7	44.3
Did know and use sterile gauze or sterile transparent semipermeable dressing to cover the catheter site?	70.2	29.8
Did disinfect the needleless connectors before administer medication or fluid?	50.8	49.2
Did you replace catheter site dressing every 7 days or if the dressing becomes visibly soiled or loosened?	63.5	36.5
Did use topical antibiotic ointment on catheter insertion site?	49.7	50.3
Did you replace the IV administration sets every 72 hours?	54.1	45.9
Did disinfect with hydrogen peroxide the catheter insertion site?	42.7	57.3
Did you use routinely anticoagulants medication?	47.7	52.3
Do you know the type of central line catheter site insertion?	76.9	23.1

5.4. Nurses' practice level for central line catheter prevention

The nurses' practice to central line catheter guidelines was determined using twenty one item checklist. Nurses who achieved total sum score of sixteen or higher were classified as having good practice in this study. Based on the category specified in the operational definition those of nurses who correctly performed $\geq 76\%$ of practice checklist said to have good practice on central line catheter. The result indicated that 250 (64.8%) of the study participants were poor practice

regarding central line catheter guidelines. On the other hand 136(35.2%) of study participants were adhered to central line catheter practice guidelines (Figure 5).

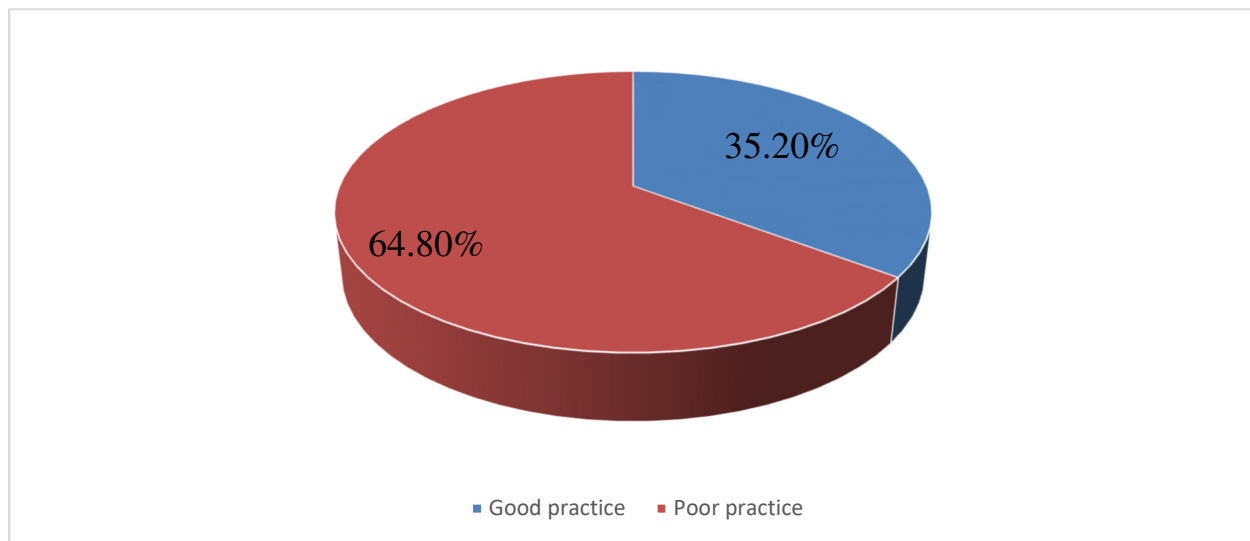


Figure 5: practice level of nurse towards prevention of central line catheter in ICU, selected public hospitals in Addis Ababa, Ethiopia, 2024

Among the participants, only 29.8% of nurse ensured hand hygiene before and after CVC care. Those 37.8% were effectively perform hand hygiene. From the respondents 36.3% of the participants dressing and Cover the site of catheter at the regular interval. Documenting dressing changes (35.0%) performing correctly, nurse Using sterile gauze or semi-permeable dressing accounts 61.4%, nursing properly monitoring catheter site only 39.1%. Nurse in ICU performed sterile procedure devices only 40.4%. Majority of nurse around 72.3% were not use topical antibiotic on the catheter site ,replacing IV administration sets every 72 hours accounts around ,36.3% ,majority of nurse 64.0% not Changing tubing every 6-12 hours .Regarding usage of 0.5% chlorhexidine around 34.5% of nurse correctly use the insertion site.67.9% of nurse not disinfecting with hydrogen peroxide. Around 61.1% of the respondent not use antiseptic to dry the site properly. Only 36.8% respondents use routinely anticoagulants before and after producer, 56.7% of the nurse not using maximal sterile barrier precautions during producer. 37.9% of the nurse performed to flush the saline into the lumen after the medication and fluid administration (table 4).

Table 4: percentage distribution of nurses’ practice towards central line catheter guidelines at selected public hospitals in Addis Ababa, Ethiopia 2024, (N=386)

Checklist	Yes(%)	No (%)
1A. Hand hygiene performed both before and after central venous catheter (CVC) care	29.8	70.2
1B. Effective hand hygiene has been achieved in the context of central venous catheter (CVC) care	37.8	62.2
2A. Dressing and cover of the catheter insertion site be changed at regular interval	36.3	63.7
2B.Documenting the dressing changing details in the patient record	35.0	65.0
2C.Sterile gauze or sterile transparent semi -Permeable dressing use to cover the catheter site	61.4	38.6
2D monitor the catheter sites visually or by palpation through an intact dressing on a regular basis	39.1	60.9
2E. when moisture, drainage fluid, or blood is found under the cover, immediately changed	53.1	46.9
3. Use of gloves before infusion port access replaces	46.4	53.6
4. Use only sterile devices to access catheters	40.4	59.6
5. Use topical antibiotic ointment use on catheter insertion sites	27.7	72.3
6A. Replace the IV administration sets at Least 72 hours	36.3	63.7
6B. Infusion sets that administer blood, blood products, or lipid emulsions through a central venous catheter was changed every 48 hours	39.9	60.1
6C. If propofol is administered, change tubing every 6-12 hours	36.0	64.0

6D. Removing unnecessary tube lines on the site of catheter	38.1	61.9
7A. Prepare and practice the insertion site With >0.5% chlorhexidine with alcohol	34.5	65.5
7B .Disinfect the catheter insertion site With hydrogen peroxide	32.1	67.9
7C.Disinfect the needless connectors before administering medication or fluid	35.2	64.8
7D.Apply the skin antiseptic on the insertion site to dry before catheter insertion	38.9	61.1
8. Use routine anticoagulants solutions	36.8	63.2
9.Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile full body drape)	43.3	56.7
10.Flush the lumen with saline after the administration of medication or fluid	37.9	62.1

5.5 Factors associated with practice level of nurses for CLC prevention

The initial association between each independent variable and the dependent variable was examined by using bivariate analysis. In bivariate analysis seven variables were associated to the outcome variable. In binary logistic regression showed that knowledge of nurse ,experience ,educational status of the nurse, nurses to patient ratio, daily monitoring and evaluation of CLC, in-service training, availability of CLC guidelines were significantly associated with practice of central line catheter infection prevention at p-value less than 0.2.To analyze further in multivariable analysis and control for potential confounding factors, all variables that are significant in the bivariate analysis should be included as candidates in the multivariable logistic regression for further examination. According to a multivariable logistic regression model knowledge of nurse 4.323(AOR = (95%CI: 2.515, 7.429)), experience 3.836(AOR= (95%CI: 1.716, 8.576)), educational status of the nurse 3.625(AOR=(95%CI:1.990,6.601)),nurse- patient ratio 2.098 (AOR= (95% CI:1.251,3.518)),in-service training 3.128 (AOR=(95%CI:1.772,5.523

)) and availability of CLC guidelines 2.928(AOR=(95%CI:1.732,4.950)) were significantly associated with practice of central line catheter infection prevention with a 95% confidence interval and a p-value less than 0.05 (Table5:).

Table 5: Multivariable logistic regression in practice level of nurses and associated factors to infection prevention of central line catheter-associated infections in intensive care units in selected hospital Addis Ababa, Ethiopia 2024,(N=386)

Variable	central line catheter practice status of nurse		COR (95%CI)	AOR (95%CI)	P – value
	Poor practice	Good practice			
Knowledge status of nurse					
Poor knowledge	166	37	1	1	
Good knowledge	84	99	5.288(3.338,8.375)	4.323(2.515,7.429)	0.000*
Experience					
6month-5 year	75	42	1	1	
5 year-10 year	123	47	0.682(0.412,1.131)	0.74 (0.408,1.342)	0.322
10-15 year	33	13	0.703(0.334,1.481)	1.289 (0.515,3.225)	0.588
>15 year	19	34	3.195(1.624,6.286)	3.836 (1.716,8.576)	0.001*
Education status					
BSC nurse	202	79	1	1	
MSC nurse critical	48	57	3.036(1.910,4.828)	3.625(1.990,6.601)	0.000*
Nurse to patient ratio					

1:2	163	57	1	1	
1:1	87	79	2.597(1.691,3.986)	2.098(1.251,3.518)	0.005*
Training					
Yes	91	78	2.35 (1.534,3.599)	3.128(1.772,5.523)	0.000*
No	159	58	1	1	
Availability of CLC guideline					
Yes	92	78	2.31(1.508,3.537)	2.928 (1.732,4.950)	0.000*
NO	158	58	1	1	
Daily monitoring and evaluation of CLC					
Yes	104	77	1.832 (1.201,2.795)	1.449 (0.864,2.430)	0.160
NO	146	59	1	1	

NB: COR: crude odd ratio, AOR: adjacent odd ratio CI: confidence interval: $p \leq 0.05$ variables significantly associated with central line catheter prevention

6. Discussion

Nurses in intensive care units (ICUs) play a crucial role in the care and maintenance of central venous catheter insertion sites. Their direct and continuous involvement ensures that these sites are managed properly, reducing the risk of complications. It is essential for ICU nurses to be well-versed in supportive care measures related to both the insertion and practice of central lines catheter (26).

Given the importance of their role, this study was conducted to assess practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses. The research was focused on selected public hospitals in Addis Ababa, Ethiopia, in 2024.

This study found that only 35.2% of nurses adhered to proper practices for CVC guidelines, indicating a significant gap in the standard of care. This issue is not unique to Ethiopia but is seen worldwide. A similar study in China reported that 43% of nurses improperly implemented CVC care guidelines(25). Conversely, this study is far higher than studies conducted in the in Egypt only 10.3 % of ICU nurses had satisfactory practice on central line prevention(30). This variation could be due to differences in methods and procedure of data collection followed, study setting, types of study design, the prevailing socio-cultural and economic contrasts between Ethiopia and the other countries.

Central line catheter practice level of nurse was influenced by many factors. The current study identified knowledge of nurse, educational status of nurse, nurse to patient ratio, experience, in serves -training of the nurse and availability of central guideline were found to be significantly associated with practice of central line prevention with a p-value of less than 0.05.

In this study, knowledge of nurse was significantly associated with central line catheter practice level of nurses. Nurses with good knowledge were 4.32 time have significantly better central line catheter practice as compared to nurse who have poor knowledge(AOR=4.323 (95%CI: 2.515, 7.429)). This is similar with a study done in United states reported (AOR = 3.9 (95% CI: 2.4,6.3)) for improved practices among nurses who received knowledge-based interventions(19), other cross-sectional study report in southern Italy show be significantly associated with practice of central line prevention (24). This finding is also supported by those study conducted in Turkey ,62 % of ICU nurse knowing regarding to practice of central line (2). This is due to nurses who are

well-informed about the best practices for central line catheter use are more likely to follow protocols, leading to better outcomes and reducing the risk of infections. In contrary this study in Saudi Arabia knowledge is weakly associated to practice of nurse(38).This is may be aware of the best practices but may not implement them consistently due to various barriers, like work environment, institutional police, training and education and behavioral and attitudinal factors.

Educational status of nurse was significantly associated with central line catheter practice level of nurses. Nurses who had a master's degree in critical care were 3.63 more likely to be better practices to infection prevent of central line catheter as compared to BSC degree holder(AOR=3.625 (95%CI: 1.990, 6.601)). This finding similar with research from Tanta University in Egypt, where half percent of nurses with master's degrees showed good CVC maintenance practices (26). Studies in Jordan, Poland and South Korea also support the notion that higher educational attainment among nurses correlates with improved patient outcomes and higher quality of care (21, 32, 39).This could be due to nurses with a master's degree likely receive more specialized training in critical care, which enhances their competency in handling complex procedures like central line catheter insertions and prevention practice. On the contrary, other study in Turkey show no significant relationship was found between the educations levels of nurse and practice of nurse in ICU(2).This may be nurses, regardless of their education level, may not receive standardized training and protocols for central line catheter prevention and lack of experience and Skills.

Working experience of nurse was significantly associated with central line catheter practice level of nurses. Nurses with over 15 years of experience were almost four times more likely to exhibit proper CVC prevention practices compared to their less experienced counterparts (AOR = 3.836, 95% CI: 1.716–8.576).This observations consistent with studies conducted in Johannesburg, United States of America and Saudi Arabia (10, 38) where longer work experience was linked to better patient outcomes. This is due to experienced nurses have had more opportunities to refine their skills and adapt to various clinical situations, resulting in improved practice standards. This study finding was also inconsistent with those studies done in Egypt(26) and Turkey(2).This is due to nurse maybe lack of continuous professional development and not follow standardized protocols .

Nurse-to-Patient Ratio: A lower nurse-to-patient ratio significantly improved CVC prevention practices. Nurses working in a 1:1 ratio setting were almost twice as likely to follow proper practices compared to those in a 1:2 ratio setting (AOR = 2.098, 95% CI: 1.251–3.518). This finding is supported by research from Poland, where 70% of nurses working with a lower nurse-to-patient ratio had higher compliance scores (32). This finding is also supported by those study conducted in China(25). This is due to lower nurse-patient ratio reduced heavy workload of nurses tasks and that simplified their decisions and improve the quality of care in ICU. Conversely, a study Nigeria (57.1%) and in Egypt(75%) found that nurses had unsatisfactory practices due to high work load of nurse in ICU(16, 30).

Training was significantly associated with central line catheter practice level of nurses. Nurses who received in-services training show almost 3 times more likely to be better practices to prevent central line catheter as compared to those who did not take training (AOR=3.128 ,95%CI: 1.772, 5.523). This in line with study conducted Addis Ababa public hospital in Ethiopia continuous education and training for ICU nurses positively effect patient outcome(10). This similar with a study done in Turkey(50%), Egypt (64%) and Saudi Arabia(60%) show that providing intensive training can positively influence the control of CLABSI by reduction rate (2, 36, 38). The reason is, in-service training increases nurses' knowledge, skills, and adherence to standardized protocols, leading to better central line practices. This results in reduced infection rates and improved patient outcomes.

Availability of CLC guideline was significantly associated with central line catheter practice level of nurses. Applying based on central line catheter guideline in the unit almost 3 times more likely to be better practices to prevent central line catheter as compared to those who did not applying guidelines(AOR=2.928 ,95%CI: 1.732, 4.950). This is similar with a study done in Austria line tertiary hospital (AOR =2.611 (95% CI: 1.632–3.920) the use of guidelines is proven to improve compliance with best practices and reduce infection rates (31). Other similar study conducted in Turkey the nurses who were aware of the existence of guidelines were thought to have practice CVC care correctly(2). This is due to guidelines serve as important tools to ensure that all necessary steps are followed during procedures, reducing the risk of omissions and errors

7. Strength & limitation of the study

7.1. Strengths of the Study

Comprehensive Data Collection. Utilized self-administered questionnaires, along with standardized checklists during observations, to gather detailed and consistent data. The study included 386 ICU nurses, ensuring a robust and representative dataset for analysis.

Focus on Critical Factors: By examining a range of factors such as knowledge, educational status, nurse-to-patient ratios, in-service training, and availability of guidelines, the study provides a comprehensive understanding of the various elements influencing CLC prevention practices.

Relevance to Public Health: The findings highlight critical intervention areas for improving CLC infection control, especially in resource-limited settings. Implementing these interventions can reduce infection rates, enhance patient outcomes, and optimize healthcare resources, significantly impacting public health.

Statistical Analysis: The use of advanced statistical methods, including the calculation of adjusted odds ratios (AOR) and confidence intervals (CI), allows for a clear understanding of the associations between various factors and CLC prevention practices.

7.2. Limitations of the Study

Cross-Sectional Design: The cross-sectional nature of the study limits the ability to establish causality between the identified factors and CLC prevention practices.

Self-Reported Data: The reliance on self-reported data for assessing knowledge and institutional factors might introduce bias, as participants may overestimate their adherence to guidelines.

Limited Geographic Scope: The study was conducted in selected public hospitals in Addis Ababa, which may limit the generalizability of the findings to other regions or private healthcare settings.

Potential for Response Bias: Participants who are more knowledgeable or have better practices might have been more willing to participate in the study, potentially skewing the results.

Unmeasured Confounding Variables: There may be other relevant factors influencing CLC prevention practices that were not measured or accounted for in this study, such as patient characteristics.

Despite these limitations, the study provides valuable insights into the current state of CLC prevention practices level among ICU nurses in Addis Ababa and identifies critical areas for improvement to enhance patient care and outcomes.

8. Conclusion and recommendation

8.1. Conclusion

Nurses who correctly performed $\geq 76\%$ of practice checklist said to have good practice on central line catheter. From this study ICU nurses in public hospitals in Addis Ababa is suboptimal, with only 35.2% demonstrating good practices. Key factors influencing these practices include nurses' knowledge, educational level, experience, nurse-to-patient ratio, in-service training, and the availability of CLC guidelines. The significant associations observed suggest that enhancing these factors could lead to better CLC prevention practices. Nurses with higher educational attainment and those who received adequate training were more likely to adhere to recommended CLC prevention protocols. This indicates that knowledge and education are critical in improving clinical practices related to CLC prevention.

8.2. Recommendation

Based on the findings, the following recommendations are proposed to improve CLC prevention practices among ICU nurses:

Enhance Training Programs: Implement regular and comprehensive in-service training programs focused on CLC prevention to ensure that all ICU nurses are well-versed in current best practices and guidelines.

Increase Educational Opportunities: Encourage and support nurses to pursue higher education, such as master's degrees in critical care, to improve their knowledge and skills in CLC prevention.

Optimize Nurse-to-Patient Ratios: Ensure optimal nurse-to-patient ratios in ICUs to allow for better monitoring and care of patients with central lines, thereby reducing the risk of infections..

Regular Monitoring and Evaluation: Establish routine monitoring and evaluation processes for CLC practices in ICUs to identify areas for improvement and to ensure adherence to protocols.

Promote Knowledge Sharing: Foster a culture of continuous learning and knowledge sharing among ICU nurses through workshops, seminars, and peer-reviewed publications on CLC prevention.

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10. Appendix

Appendix I: Information Sheet

Name of the investigator: Mebratu Belete (MSC in emergency and critical care nursing).

Proposal title: Practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in ICU of public hospitals, Addis Ababa, Ethiopia, 2024

Purpose of the study: To assess practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in ICU of public hospitals, Addis Ababa, Ethiopia, 2024.

Confidentiality: The collected information were kept confidential and used only for research purpose. No one except the investigator of the research was have access to the information collected. The name and/or other personal information of patients were not be notified in any report. All paper records of the study was kept in a secured place under lock when not in use.

Personal contact: If the data collectors, supervisors or other hospital administrative staffs have any question regarding the study they were free to contact me in person or by these addresses.

Cell phone: +251966497393

Email: mebratu2193@gmail.com

Appendix – II: Hospitals Consent

This study was carried out at St. Paul Hospital Millennium Medical College (SPHMMC), AaBET hospital, Blake Lion, St. Peter hospital, Zewiditu Memorial hospital, Menilik II hospital and Yikatete 12 Hospital, which all are the biggest hospitals of Addis Ababa, Ethiopia. The main purpose of this study is to assess practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in ICU of public hospitals, Addis Ababa, Ethiopia, 2024. The result was used to provide information about prevention of central line catheter associated infections in intensive care units those public hospitals and for all responsible body which help to give future direction on way of prevention and effective management of central line catheter. Any nurse's personal information such as the name, any private details kept confidential throughout study period and the generated information was disclosed in full. The hospital has full right to accept or refuse study whenever it needs. Whenever there is need of more information (explanation) on proposed study the principal investigator could be contacted in person or through phone number: +251966497393 (Mebratu Belete principal investigator). Finally if you agree whether the study was conducted at your institution, please confirm it by putting your sign.

Consent Form

Do you agree to participate in this study?

☐ Yes, I agree to participate in the study, ☐ No, I don't want to participate in the study

I certify that I have read the above consent procedure to the participant

Name and sign of data collector -----Date of consent_____.

Name of study site (hospital name) _____Identification Number-----

Date and Sign of interviewer ----- Supervisor name and sign -----

Appendix - III: Questionnaire

Direction: please indicate your response (✓) your choice or by writing the appropriate information in the space provided. You can skip any question that you feel were not applicable to you. Data collecting tool practice towards critical care nurses on evidence-based guidelines for the prevention of central venous catheters:

Table 6: Questions on demographic data, institutional related, knowledge related factors and catheter care practice related factors of nurses in ICU public hospital in Addis Ababa, 2024

PART 1 :(Demographic data)

Code	Questions	Alternative response
101	Sex	Male ☐ Female ☐
102	How old are you?	------(years)
103	Educational Qualification	BSC nursing/degree MSC Nursing (critical care in nurse) ☐
104	Work experience in ICU	< 5 years ☐ 5-10 years ☐ 10-15 years ☐ >15 years ☐
105	Nursing work experience	in years/months
106	Monthly income	------(Ethiopian birr)

107	Which hospital are you working in?	Blake lion ☐ St.paul's hospital ☐ St. peter's hospital ☐ Yikatete hospital ☐ AaBET hospital ☐ Meilnik hospital ☐
108	Which unit now you work?	Medical HDU ☐ Surgical HDU ☐ Adult ICU ☐ PICU ☐ NICU ☐

Part 2: Institutional related factors

Co de	Questions	Alternative response
201	Did your institution have prepared evidence based CLC guidelines?	Yes ☐ No ☐
202	Nurse to patient ratio	1:1 ☐ 1:2 ☐
203	Did you attend any in-service training in intensive care unit?	Yes ☐ No ☐
204	If yes what type of in-service training attended? Select more than one	Endotracheal suctioning ☐ Prevention of VAP ☐ Advanced Cardiac Life

		Support ☐ CLC practice ☐
205	If your answer is yes for Q. No 203, what was the mode of training course?	Face-to-face ☐ Online ☐ Mixed ☐
206	If your answer is yes for Q. No 203, Time since receiving the last training course	in years/months
207	Did you have hospital protocol and police regarding to CLC care?	Yes ☐ No ☐
208	If your answer is yes for Q. No 207, do apply the practice based on the protocol and police of the hospital?	Yes ☐ No ☐
209	Did you have available resource in your ICU? (Glove, syringe, Providian iodine, chloroxidone, hydrogen per oxide, personal protective equipment, IV set, water and soap etc...)	Yes ☐ No ☐
210	Do you have monitor or evaluation central line catheter in your unit daily?	Yes ☐ No ☐

Part 3: knowledge related factors

Code	Question	Alternative response	
301	Did you know about the guidelines of practice in central line catheter?	Yes ☐	No ☐
302	Did you flush the lumen with normal saline after the administration of medication or fluid?	Yes ☐	No ☐
303	Did use sterile gauze or sterile transparent semipermeable dressing to cover the catheter site?	Yes ☐	No ☐

304	Did disinfect the needleless connectors before administer medication or fluid?	Yes ☐	No ☐
305	Did you replace catheter site dressing every 7 days or if the dressing becomes visibly soiled or loosened?	Yes ☐	No ☐
306	Did use topical antibiotic ointment on catheter insertion site?	Yes ☐	No ☐
307	Did you replace the IV administration sets every 72 hours?	Yes ☐	No ☐
308	Did disinfect with hydrogen peroxide the catheter insertion site?	Yes ☐	No ☐
309	Did you use routinely anticoagulants medication?	Yes ☐	No ☐
310	Did you know the type of central line catheter site insertion?	Yes ☐	No ☐
311	If yes Q.NO 310 which type of CLC insert for your patient?	Subcalivan ☐ Femoral ☐ Internal jugular ☐	
312	Did you know the time /date of catheter insertion?	Yes ☐	No ☐
313	If yes Q 313 how long catheter insertion stay on patient?	----- (date ,time ,month)	

Part: 4 practice related factors

CODE		Checklist	Yes (%)	No (%)
401	Hand hygiene	A. Hand hygiene performed both before and after central venous catheter (CVC) care		

		B. Effective hand hygiene has been achieved in the context of central venous catheter (CVC) care		
402	Dressing Practice	A. Dressing and cover of the catheter insertion site be changed at regular interval		
		B .Documenting the dressing changing details in the patient record		
		C. Sterile gauze or sterile transparent semi - Permeable dressing use to cover the catheter site		
		D monitor the catheter sites visually or by palpation through an intact dressing on a regular basis		
		E. when moisture, drainage fluid, or blood is found under the cover, immediately changed		
403		Use of gloves before infusion port access replaces		
404		Use only sterile devices to access catheters		
405		Use topical antibiotic ointment use on catheter insertion sites		
406	Infusion set	A. Replace the IV administration sets at Least 72 hours		
		B. Infusion sets that administer blood, blood products, or lipid emulsions through a central venous catheter was changed every 48 hours		

		C. If propofol is administered, change tubing every 6-12 hours		
		D. Removing unnecessary tube lines on the site of catheter		
407	Antiseptic practice	A .Prepare and practice the insertion site With >0.5% chlorhexidine with alcohol		
		B .Disinfect the catheter insertion site With hydrogen peroxide		
		Disinfect the needless connectors before administering medication or fluid		
		7D.Apply the skin antiseptic on the insertion site to dry before catheter insertion		
408		Use routine anticoagulants solutions		
409		Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile full body drape)		
410		Flush the lumen with saline after the administration of medication or fluid		

Appendix – IV: Declaration

I declare that this research proposal entitled “**Practice level and associated factors towards central line catheter associated blood stream infection prevention practice among nurses in ICU of public hospitals, Addis Ababa, Ethiopia, 2024**” is my own work that have not been addressed in the study area as far as my knowledge touched and all the sources I used has been indicated and acknowledged as complete reference.

Name of investigator	Sign	Date
Mebratu Belete	-----	5/8/2024
Name of advisors		
1. Tangute Demas (BSc, MSc/Assistant prof)	-----	5/8/2024
2. Ayele Fikadu (MSC)	-----	5/8/2024
Name of examiners		
1. Birhanu	-----	5/8/2024
2. Zerhune	-----	5/8/2024