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NURSES' KNOWLEDGE AND PRACTICES REGARDING INFECTION PREVENTION MEASURES IN CARDIAC INTENSIVE CARE UNIT

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Abstract: **Background: Healthcare-associated infections (HAIs) remain a major global patient safety challenge, contributing substantially to morbidity, mortality, prolonged hospitalization, antimicrobial resistance, and increased healthcare costs. Patients admitted to cardiac intensive care units (ICUs) are particularly vulnerable because of their critical illness, frequent exposure to invasive devices, and complex cardiovascular interventions. Nurses play a pivotal role in preventing HAIs through the consistent implementation of evidence-based infection prevention and control (IPC) measures. Therefore, assessing both nurses' knowledge and their observed clinical practices is essential for identifying strengths, potential gaps, and opportunities for quality improvement.**

Aim: To assess nurses' knowledge and observed practices regarding infection prevention measures in a cardiac intensive care unit and to examine the relationship between knowledge level and practice competency.

Methods: A descriptive cross-sectional study was conducted using a census sampling approach involving all eligible registered nurses (N = 46) permanently employed in the Adult Cardiac Intensive Care Unit at Aswan Heart Center, Egypt. Data were collected using a structured self-administered knowledge questionnaire developed in accordance with World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) infection prevention recommendations, together with a standardized observational checklist adapted from the CDC Infection Control Assessment and Response (ICAR) Tool. Each nurse was observed during three separate clinical shifts to enhance the reliability of practice assessment. Data were analyzed using IBM SPSS Statistics version 21. Descriptive statistics summarized participants' characteristics, knowledge, and practice levels, while Pearson's Chi-square test examined the association between knowledge level and practice competency. Statistical significance was established at $p < 0.05$.

Results: Thirty nurses (65.2%) demonstrated good knowledge, whereas sixteen (34.8%) demonstrated fair knowledge; none exhibited poor knowledge. Overall, observed infection prevention practices were competent across all assessed domains, with compliance meeting or exceeding the predefined competency threshold. High adherence was observed for ventilator care, medication preparation, airborne isolation precautions, sharps disposal, and personal protective equipment use, whereas comparatively lower compliance was identified in hand hygiene and urinary catheter care. No statistically significant association was found between nurses' knowledge level and observed practice competency ($\chi^2 = 0.013$, $p = 0.910$).

Conclusion: Nurses working in the cardiac intensive care unit demonstrated satisfactory theoretical knowledge and competent implementation of evidence-based infection prevention measures. However, theoretical knowledge alone did not predict observed clinical performance, indicating that organizational support, standardized clinical protocols, continuous competency assessment, and institutional safety culture may exert greater influence on

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adherence than knowledge alone. Sustaining high-quality infection prevention practices therefore requires multifaceted strategies integrating continuous professional education, routine observational auditing, performance feedback, and strong organizational commitment to patient safety.

Keywords: **Infection prevention and control; Healthcare-associated infections; Cardiac intensive care unit; Nurses; Knowledge; Clinical practice; Patient safety; Infection control.**

1. INTRODUCTION

Healthcare-associated infections (HAIs) remain one of the most significant threats to patient safety worldwide, contributing substantially to preventable morbidity, mortality, prolonged hospitalization, antimicrobial resistance, and escalating healthcare costs. Despite considerable advances in medical technology and infection prevention strategies, HAIs continue to affect millions of patients annually across both developed and developing healthcare systems. The World Health Organization (WHO) estimates that, at any given time, approximately 7% of hospitalized patients in high-income countries and 15% in low- and middle-income countries acquire at least one healthcare-associated infection during hospitalization, with intensive care units (ICUs) consistently demonstrating the highest infection burden due to the complexity of patient care and the frequent use of invasive medical devices (World Health Organization [WHO], 2022).

The burden of HAIs is particularly pronounced within intensive care units, where critically ill patients frequently require mechanical ventilation, central venous catheterization, arterial catheterization, urinary catheterization, extracorporeal circulatory support, temporary pacing devices, renal replacement therapy, and prolonged hospitalization. These life-saving interventions simultaneously increase susceptibility to device-associated infections, including central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), catheter-associated urinary tract infections (CAUTIs), and surgical site infections (SSIs). Such infections are associated with increased mortality, prolonged ICU stay, higher healthcare expenditure, increased antimicrobial consumption, and the emergence of multidrug-resistant microorganisms (Buetti et al., 2022; WHO, 2022).

Cardiac intensive care units represent an especially challenging clinical environment for infection prevention because patients often present with advanced cardiovascular disease, postoperative immunological stress, impaired tissue perfusion, multiple invasive monitoring devices, and complex surgical wounds. Following cardiac surgery, patients commonly require prolonged mechanical ventilation, temporary epicardial pacing wires, mediastinal and pleural drainage systems, central venous catheters, arterial lines, urinary catheters, and repeated vascular access procedures. Collectively, these interventions substantially increase opportunities for microbial transmission and healthcare-associated infections. Consequently, maintaining rigorous infection prevention and control (IPC) measures is fundamental to improving patient outcomes and reducing preventable complications within cardiac critical care settings (Centers for Disease Control and Prevention [CDC], 2024; Buetti et al., 2022).

Among healthcare professionals, nurses occupy a central position in infection prevention because they provide continuous bedside care throughout the patient's hospitalization. Their responsibilities encompass hand hygiene, aseptic technique during invasive procedures, management of vascular access devices, urinary catheter care, ventilator care, wound management, medication administration, environmental cleaning, isolation precautions, and patient and family education. Consequently, nurses' adherence to evidence-based IPC practices directly influences patient safety and healthcare quality. Numerous studies have demonstrated that high compliance with standard precautions significantly reduces the incidence of healthcare-associated infections, particularly those associated with invasive devices commonly used in intensive care units (Glowicz et al., 2023; WHO, 2022).

Recognizing the critical importance of infection prevention, several international organizations have developed comprehensive evidence-based recommendations to support healthcare institutions. The WHO Global Report on Infection Prevention and Control identifies effective IPC programs as one of the most cost-effective interventions for improving healthcare quality and reducing preventable patient harm. Similarly, the CDC Core Infection Prevention and Control Practices and the Society for Healthcare Epidemiology of America (SHEA), Infectious Diseases Society of America (IDSA), and Association for Professionals in Infection Control and Epidemiology (APIC) guidelines emphasize that successful infection prevention depends upon continuous education, adherence monitoring, competency assessment, leadership engagement, multidisciplinary collaboration, and implementation of standardized care bundles rather than reliance on individual knowledge alone (CDC, 2024; Glowicz et al., 2023; WHO, 2022).

Although infection prevention guidelines are widely available, adherence to recommended practices remains inconsistent across healthcare institutions and geographical regions. Previous studies have reported substantial variation in nurses' knowledge and compliance with infection prevention measures, influenced by multiple interacting factors including educational preparation, years of professional experience, workload intensity, staffing adequacy, organizational culture, leadership support, availability of infection prevention resources, and institutional safety climate (Batran et al., 2025; Kim et al., 2025). While many healthcare professionals demonstrate satisfactory theoretical knowledge, translating this knowledge into consistent clinical practice remains a persistent challenge.

Contemporary implementation science suggests that knowledge alone is insufficient to ensure sustained evidence-based practice. The Knowledge-to-Action Framework proposes that successful implementation requires integration of individual knowledge with organizational support, continuous performance monitoring, audit and feedback mechanisms, leadership commitment, and an enabling clinical environment (Graham et al., 2006). Consequently, healthcare professionals with comparable knowledge may demonstrate markedly different clinical performance depending on institutional context. This concept is particularly relevant in critical care settings, where standardized protocols, multidisciplinary teamwork, and organizational culture strongly influence adherence to infection prevention practices (Alodhialah, 2025).

Although infection prevention has been extensively investigated internationally, evidence specifically addressing nurses' knowledge and observed infection prevention practices within specialized cardiac intensive care settings remains relatively limited, particularly in low- and middle-income countries. In Egypt, published evidence describing infection prevention performance among cardiac ICU nurses is scarce despite the increasing complexity of cardiovascular services and growing emphasis on patient safety and healthcare quality. Furthermore, many previous investigations have relied primarily on self-reported questionnaires, which may overestimate actual clinical practice because of recall and social desirability bias. Direct observational assessment provides a more objective evaluation of routine infection prevention behaviors and better reflects actual clinical performance.

Therefore, assessing both nurses' knowledge and observed clinical practice within a specialized cardiac intensive care unit is essential for identifying strengths, recognizing opportunities for improvement, and informing evidence-based quality improvement initiatives. The findings of the present study may support nursing administrators, infection prevention specialists, hospital leaders, and policymakers in developing targeted educational interventions, strengthening competency assessment programs, and optimizing institutional infection prevention strategies to enhance patient safety and reduce healthcare-associated infections.

Significance of the Study

Healthcare-associated infections remain a major challenge to patient safety despite substantial advances in infection prevention and control (IPC) strategies. Although comprehensive international guidelines developed by the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the Society for Healthcare Epidemiology of America (SHEA) provide evidence-based recommendations for preventing healthcare-associated infections, variability in healthcare professionals' adherence to these recommendations continues to be reported across healthcare settings. Such variability is influenced by multiple factors, including differences in professional knowledge, institutional safety culture, workload, leadership support, resource availability, and continuous competency assessment (WHO, 2022; CDC, 2024; Glowicz et al., 2023).

Cardiac intensive care units represent one of the most infection-sensitive clinical environments because patients frequently require prolonged mechanical ventilation, central venous and arterial catheterization, urinary catheterization, temporary pacing devices, extracorporeal circulatory support, and postoperative wound management. Consequently, even minor deviations from evidence-based infection prevention practices may substantially increase the risk of device-associated infections, adverse clinical outcomes, prolonged hospitalization, and healthcare costs (Buetti et al., 2022).

Although numerous international studies have evaluated infection prevention practices among healthcare professionals, evidence specifically addressing nurses working in specialized cardiac intensive care units remains limited, particularly within low- and middle-income countries. Furthermore, many previous investigations have relied primarily on self-reported questionnaires, which may overestimate actual clinical practice because of recall bias and socially desirable responses. Direct observational assessment provides a more accurate evaluation of routine infection prevention behaviors and allows identification of practice gaps that may not be detected through self-report alone (Raurell-Torredà et al., 2024).

The present study addresses these gaps by simultaneously evaluating nurses' knowledge and directly observed infection prevention practices within a specialized cardiac intensive care setting. By examining the relationship between theoretical knowledge and clinical performance, the study provides a comprehensive understanding of infection prevention competency among critical care nurses. The findings are expected to generate context-specific evidence that supports nursing administrators, infection prevention specialists, hospital leaders, and policymakers in designing targeted educational interventions, strengthening competency assessment programs, enhancing institutional infection prevention strategies, and ultimately improving patient safety and quality of care.

Aim of the Study

To assess nurses' knowledge and observed practices regarding infection prevention measures in a cardiac intensive care unit and to examine the relationship between knowledge level and practice competency.

Research Questions

The present study sought to answer the following research questions:

1. What is the level of nurses' knowledge regarding infection prevention measures in the cardiac intensive care unit?
2. What is the level of nurses' observed clinical practice regarding infection prevention measures in the cardiac intensive care unit?
3. Is there a statistically significant association between nurses' knowledge level and observed practice competency regarding infection prevention measures?

Operational Definitions

These definitions also need substantial strengthening. Journals expect conceptual definitions followed by operational definitions that explain **exactly how the variable was measured in the study**.

Nurses' Knowledge Regarding Infection Prevention

Conceptually, nurses' knowledge refers to the cognitive understanding of evidence-based principles governing infection prevention and control, including standard precautions, hand hygiene, aseptic technique, personal protective equipment, environmental hygiene, isolation precautions, and prevention of device-associated infections according to internationally recognized guidelines (WHO, 2022; CDC, 2024).

Operationally, nurses' knowledge was measured using a structured self-administered questionnaire developed according to WHO and CDC infection prevention recommendations. Each correct response received one point, and the total score was converted into a percentage. Knowledge levels were categorized as:

- **Good knowledge:** ≥80%
- **Fair knowledge:** 60%–79%
- **Poor knowledge:** <60%

Nurses' Infection Prevention Practice

Conceptually, infection prevention practice refers to nurses' consistent implementation of evidence-based infection prevention and control measures during routine patient care to minimize the transmission of healthcare-associated infections.

Operationally, nurses' clinical practice was evaluated using a standardized observational checklist adapted from the CDC Infection Control Assessment and Response (ICAR) Tool. The checklist assessed adherence to evidence-based practices including hand hygiene, personal protective equipment utilization, central venous catheter care, urinary catheter care, ventilator-associated pneumonia prevention measures, environmental infection control, sharps safety, medication preparation, and isolation precautions. Each correctly performed practice received one point. Total scores were converted into percentages, and nurses achieving **≥80%** of the total score were classified as **competent**, whereas those scoring **<80%** were classified as **incompetent**.

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2. PARTICIPANTS AND SAMPLING

Subject

The study subject consisted of all registered nurses permanently employed in the AICU who met the inclusion criteria. Approximately 46 nurses were eligible to participate.

Inclusion Criteria

The inclusion criteria included all permanent nurses working in the AICU at Aswan Heart Center with more than one year of experience.

Sampling Size and Type

A convenience sampling method was employed, aiming to include all eligible participants from the adult intensive care unit at Aswan Heart Center. As the number of participants was low and all nurses working in the AICU accepted to participate in the study.

Sample Size Calculation

The sample size will be calculated using the following formula:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{d^2}$$

Where:

- n = required sample size
- Z = Z-value (1.96 for 95% confidence level)
- p = estimated proportion of the population (use 0.5 for maximum variability)
- d = margin of error (0.05 or 5%)

For this study, with a population of approximately 46 nurses, Convenience sampling was used to include all eligible participants, consistent with similar descriptive ICU studies.

Data Collection Tools

Two data collection tools were used:

Tool I: Intensive Care Unit Nurse's Knowledge Regarding Infection Preventive Measures Self-Administered Questionnaire

The questionnaire was developed by the investigator after a thorough review of the related and relevant literature. It contains two parts:

- **Part 1: Demographic Characteristics** - This section collected data about participants' age, gender, educational background, years of experience, and previous training related to infection prevention.
- **Part 2: Knowledge Assessment** - Nurses' knowledge regarding infection prevention measures in the ICU was assessed. The questionnaire covered critical aspects of infection control practices, including hand hygiene, use of personal protective equipment, sterilization, and isolation precautions. The total number of questions was 20.

Scoring System for Tool I

Each correct answer awarded one point.

- A total score of 80% or higher were classified as "Good Knowledge."
- A total score between 60% and 79% were classified as "Fair Knowledge."
- A total score of less than 60% were classified as "Poor Knowledge."

Tool II: Observational Checklist

A structured observational checklist was used to assess nurses' adherence to infection prevention protocols during routine clinical care. This checklist was adapted from the CDC ICAR tool and evaluated hand hygiene, use of PPE, aseptic techniques, and environmental sanitation (CDC, 2022).

Scoring System for Tool II

Each correctly performed practice will be given one point.

- A performance score of 80% or higher will indicate that the nurse is "Competent."
- A performance score of less than 80% will indicate that the nurse is "Incompetent."
- Validity and Reliability of the Tools.

The data collection instruments were subjected to rigorous validation and reliability procedures to ensure their scientific soundness and suitability for the study context.

A pilot study was conducted on approximately 10% of the total sample (n=5) of nurses who met the inclusion criteria. The pilot aimed to evaluate the clarity, applicability, and time feasibility of the data collection tools in the clinical environment. Based on the pilot findings, there were no modifications made and since no revisions were required, the data from the pilot were retained for inclusion in the final analysis.

To determine internal consistency reliability, Cronbach's alpha coefficient was computed for both instruments. A Cronbach's alpha value equal to or greater than 0.70 was considered acceptable, reflecting adequate reliability (Taber, 2018). The knowledge questionnaire demonstrated a Cronbach's alpha of 0.86, while the observational checklist yielded a coefficient of 0.88, indicating high internal consistency. These results indicated that the instruments were valid, reliable, and appropriate for assessing nurses' knowledge and practices regarding infection prevention in the Adult Intensive Care Unit of Aswan Heart Centre.

Data Collection Procedure

Data collection took place over three months. Observational data were collected first to minimize bias from questionnaire completion. Each participant was observed on three separate occasions across different shifts (morning, evening, and night) to capture shift-related variation. Observations were performed covertly by the researcher who used the standardized ICAR-based checklist. After completion of the observational phase, participants were invited to complete the self-administered knowledge questionnaire under supervised but private conditions to ensure independent responses.

All data were anonymized by allocating unique numeric codes to participants; no personal identifiers were recorded.

Ethical Considerations

Ethical approval was obtained from the Ethical Committee of the Faculty of Nursing, British University in Egypt, and the Postgraduate Studies Committee. Then the proposal was submitted to the Ethical Committee of the University to obtain final Approval. Institutional permission was obtained from Aswan Heart Center (AHC) after submitting a formal letter clearly explaining the purpose and procedures of the study. A signed consent form documented a formal approval from the institution. Each participating nurse was required to sign an informed consent form, which contained detail the study's aims, procedures, expected benefits, data usage, confidentiality measures, and their rights as participants. Participants were informed that their participation is voluntary, and they have the right to withdraw from the study at any time without facing any penalties or consequences. All collected data is kept confidential and securely stored, with access restricted to the research team. Personal identifiers were not used in any reports, publications, or presentations, and the data were used exclusively for the current study. Throughout the research process, participants were treated equally, respectfully, and ethically, with full measures taken to ensure their privacy, dignity, and psychological well-being.

3. DATA ANALYSIS

In this study, data analysis was conducted through a well-organized and methodical approach to ensure findings were accurate, reliable, and meaningful. Once data collection concluded, all questionnaires and observational checklists underwent a manual review to confirm they were complete, legible, and consistent. Each document received a unique identification code to maintain confidentiality while enabling the researcher to connect knowledge scores with practice observations for each nurse.

The coded data were input into the Statistical Package for Social Sciences (SPSS) version 21, which was the main tool for managing and analyzing the data. Data entry was meticulously performed and double-checked to minimize errors. After entry, the dataset was examined for missing values, outliers, and inconsistencies. Minor errors, such as typographical mistakes or omitted responses, were corrected using the original paper questionnaires. No significant missing data were found that required imputation, so all valid cases were included in the subsequent analysis.

Descriptive statistics summarized the demographic characteristics of the participating nurses, including age, gender, education level, years of experience, and prior infection prevention training. Frequencies and percentages were calculated for categorical variables, while means and standard deviations were determined for continuous variables, such as age in years and total knowledge scores. The knowledge assessment comprised 20 items, each scored as correct (1) or incorrect (0). A composite knowledge score was calculated for each participant by summing all correct answers, with total scores ranging from 0 to 20. To aid interpretation, scores were converted into three performance categories based on established cutoffs: Good Knowledge (≥80%), Fair Knowledge (60–79%), and Poor Knowledge (<60%).

These categories were created using SPSS's "Recode into Different Variables" function, allowing the creation of a new variable representing the knowledge level. Similarly, practice data from the observational checklist were scored and summed to produce total practice scores, categorized as "Competent" (≥80%) and "Incompetent" (<80%), following standardized criteria adapted from the CDC ICAR tool. Inferential statistics were used to explore relationships between variables.

Inferential statistics were used to examine relationships between selected variables. The association between nurses' knowledge level and practice competency was analyzed using the chi-square test. A significance level of $p < 0.05$ was considered statistically significant. All statistical analyses were performed using SPSS version 21., where appropriate, to compare mean scores across different demographic groups. A significance level of $p < 0.05$ was applied to all statistical tests. All results are presented in tables and graphs for clarity, including bar charts for categorical comparisons and tables summarizing inferential statistical outcomes. The final output provided a comprehensive overview of nurses' knowledge and practices, allowing conclusions to be drawn about areas of strength and gaps needing targeted interventions.

4. RESULTS

Participants' Demographic and Professional Characteristics

A total of **46 registered nurses** participated in the study, yielding a response rate of **100%**. The participants had a mean age of **26.15 ± 3.16 years**, with most nurses (82.6%) having fewer than five years of clinical experience. Females constituted a slightly higher proportion of the study population (52.2%) than males (47.8%). Most participants held a bachelor's degree in nursing (84.8%), and approximately three-quarters (71.7%) had previously received infection prevention training.

Table 1. Demographic and Professional Characteristics of the Participating Nurses (N = 46)

Variable	n	%
Age (years)		
18–<22	1	2.2
22–<26	23	50.0
26–<30	15	32.6
≥30	7	15.2
Mean ± SD	**26.15 ± 3.16**	
Gender		
Male	22	47.8
Female	24	52.2
Years of Nursing Experience		
<5 years	38	82.6
5–10 years	8	17.4
Mean ± SD	**3.2 ± 1.5**	
Educational Qualification		

Diploma	6	13.0
Bachelor's degree	39	84.8
Master's degree	1	2.2
Previous Infection Prevention Training		
Yes	33	71.7
No	13	28.3

Nurses' Knowledge Regarding Infection Prevention Measures

The participating nurses demonstrated satisfactory knowledge regarding infection prevention measures. Correct responses ranged from **80.4% to 91.3%**, indicating consistently high knowledge across all assessed domains. The highest level of knowledge was observed for the appropriate agent used for routine hand disinfection (91.3%), whereas relatively lower—but still satisfactory—knowledge was identified regarding prevention of central line-associated bloodstream infections and environmental infection prevention (80.4%).

Table 2. Nurses' Knowledge Regarding Infection Prevention Measures (N = 46)

No.	Knowledge Item	Correct n (%)	Incorrect n (%)
1	Most effective method to prevent spread of infection in ICUs	39 (84.8)	7 (15.2)
2	Appropriate time for hand hygiene	40 (87.0)	6 (13.0)
3	Appropriate agent for routine hand disinfection	42 (91.3)	4 (8.7)
4	Frequency of changing transparent central line dressings	41 (89.1)	5 (10.9)
5	Recommended head-of-bed elevation for ventilated patients	39 (84.8)	7 (15.2)
6	Essential measure for preventing CAUTIs	41 (89.1)	5 (10.9)
7	Correct order for removing PPE	40 (87.0)	6 (13.0)
8	Primary measure for preventing VAP	38 (82.6)	8 (17.4)
9	Correct glove use	41 (89.1)	5 (10.9)
10	Recommended duration of alcohol-based hand rubbing	38 (82.6)	8 (17.4)
11	Measure reducing bloodstream infection with central venous catheters	37 (80.4)	9 (19.6)
12	Indication for contact precautions	40 (87.0)	6 (13.0)
13	Minimum recommended alcohol concentration	41 (89.1)	5 (10.9)
14	Standard precautions applied to all patients	38 (82.6)	8 (17.4)
15	Precautions for *Clostridioides difficile* infection	40 (87.0)	6 (13.0)
16	Indications for sterile gloves	38 (82.6)	8 (17.4)
17	Handling linen contaminated with body fluids	40 (87.0)	6 (13.0)
18	Situations requiring hand hygiene	40 (87.0)	6 (13.0)
19	Environmental infection prevention in ICUs	37 (80.4)	9 (19.6)
20	Transmission-based precautions	40 (87.0)	6 (13.0)

Overall Level of Nurses' Knowledge

Based on the predetermined scoring criteria, nearly two-thirds of the participating nurses (65.2%) demonstrated **good knowledge**, whereas the remaining participants (34.8%) demonstrated **fair knowledge**. None of the participants were classified as having poor knowledge, indicating that all nurses achieved at least the minimum acceptable level of infection prevention knowledge.

Table 3. Overall Level of Nurses' Knowledge Regarding Infection Prevention Measures (N = 46)

Knowledge Level	n	%
Good	30	65.2
Fair	16	34.8
Poor	0	0.0

Nurses' Practice Competency Regarding Infection Prevention Measures

Direct observation demonstrated satisfactory adherence to infection prevention practices across all evaluated domains. The highest compliance rates were observed for airborne isolation precautions (100%), medication preparation (97.8%), ventilator care (95.7%), and sharps disposal (91.3%). Lower compliance was observed for urinary catheter care and hand hygiene (69.6% each), suggesting these domains may benefit from targeted quality improvement interventions.

Table 4. Nurses' Practice Competency Regarding Infection Prevention Measures (N = 46)

Practice Domain	Competent n (%)	Incompetent n (%)
Central line care	40 (87.0)	6 (13.0)
Urinary catheter care	32 (69.6)	14 (30.4)
Ventilator care	44 (95.7)	2 (4.3)
Hand hygiene	32 (69.6)	14 (30.4)
Personal protective equipment	41 (89.1)	5 (10.9)
Contact isolation	37 (80.4)	9 (19.6)
Airborne isolation	46 (100.0)	0 (0.0)
Sharps disposal	42 (91.3)	4 (8.7)
Medication preparation	45 (97.8)	1 (2.2)

Association Between Nurses' Knowledge Level and Practice Competency

The relationship between nurses' knowledge level and observed practice competency was examined using the Pearson Chi-square test. No statistically significant association was identified between the two variables ($\chi^2 = 0.013$, df = 1, $p = 0.910$), indicating that higher knowledge levels were not significantly associated with better observed infection prevention practices.

Table 5. Association Between Nurses' Knowledge Level and Practice Competency (N = 46)

Statistical Test	Value
Pearson Chi-square (χ^2)	0.013
Degrees of freedom (df)	1
p-value	0.910

5. DISCUSSION

The present study assessed nurses' knowledge and observed practices regarding infection prevention measures in the Adult Cardiac Intensive Care Unit and examined the relationship between knowledge level and practice competency. Overall, the findings demonstrated satisfactory theoretical knowledge and competent implementation of evidence-based infection prevention measures. Approximately two-thirds of the nurses demonstrated good knowledge, while the remainder achieved fair knowledge. Likewise, observed infection prevention practices were generally satisfactory across all assessed domains. However, no statistically significant association was found between knowledge level and observed practice competency. These findings suggest that although adequate knowledge is fundamental for safe practice, clinical performance is influenced by additional organizational and environmental factors.

The satisfactory knowledge demonstrated by the participating nurses may reflect the high proportion of nurses who had previously received infection prevention training and the specialized nature of cardiac intensive care practice. Working routinely with invasive devices such as central venous catheters, urinary catheters, and mechanical ventilation may reinforce nurses' familiarity with infection prevention principles and institutional protocols. Similar findings have been reported by **Kim et al. (2025)** and **Batran et al. (2025)**, who found satisfactory infection prevention knowledge among critical care nurses. Nevertheless, slightly lower knowledge was observed for prevention of central line-associated bloodstream infections, ventilator-associated pneumonia, and environmental infection control, highlighting the need for continuous professional education. These findings are consistent with current international recommendations emphasizing regular competency assessment and ongoing education to maintain evidence-based infection prevention practices (WHO, 2022; Buetti et al., 2022).

Similarly, nurses demonstrated satisfactory adherence to infection prevention practices, particularly regarding airborne isolation precautions, medication preparation, ventilator care, personal protective equipment, and central venous catheter care. These findings suggest effective implementation of institutional infection prevention protocols within the studied unit. Comparable results have been reported among critical care nurses working in organizations with structured infection prevention programs and standardized clinical protocols (Erikson et al., 2023; Kim et al., 2025). However, comparatively lower compliance was observed for hand hygiene and urinary catheter care. Although these domains remained acceptable overall, they represent opportunities for quality improvement because both are highly dependent on continuous adherence during routine patient care. Previous studies have shown that workload, staffing levels, competing clinical priorities, and organizational safety culture may influence compliance with these practices despite adequate theoretical knowledge (Glowicz et al., 2023; WHO, 2022).

The present study demonstrated no statistically significant association between nurses' knowledge level and observed practice competency ($\chi^2 = 0.013$, $p = 0.910$). This finding indicates that higher theoretical knowledge did not necessarily translate into better clinical performance. Although knowledge is an essential prerequisite for evidence-based practice, it represents only one determinant of healthcare professionals' behavior. Similar findings have been reported by **Kim et al. (2025)**, who observed that compliance with standard precautions was influenced by organizational and behavioral factors beyond knowledge alone. According to the **Knowledge-to-Action Framework**, successful implementation of evidence-based practice requires not only knowledge acquisition but also leadership support, institutional policies, availability of resources, continuous audit and feedback, and a positive organizational culture (Graham et al., 2006). Consequently, nurses with similar knowledge levels may demonstrate different clinical performance depending on their working environment.

The absence of a significant relationship between knowledge and practice may also reflect the highly standardized nature of cardiac intensive care. Nurses working in specialized critical care units routinely follow evidence-based protocols, clinical pathways, and infection prevention bundles that promote consistent practice regardless of individual differences in theoretical knowledge. Recent evidence indicates that organizational safety culture, supportive leadership, and continuous quality improvement initiatives contribute substantially to sustaining adherence to infection prevention measures (Alodhialah, 2025; Erikson et al., 2023). Therefore, improving infection prevention practices requires multifaceted interventions that extend beyond educational activities alone.

Overall, the findings of the present study suggest that the Adult Cardiac Intensive Care Unit maintains an appropriate infection prevention culture supported by satisfactory levels of nurses' knowledge and competent clinical practice. Nevertheless, the comparatively lower performance observed in hand hygiene and urinary catheter care emphasizes the need for continuous monitoring and targeted educational reinforcement. Regular competency assessment, observational audits, timely performance feedback, and sustained leadership commitment should remain integral components of infection prevention programs to ensure long-term compliance with international standards and further reduce the risk of healthcare-associated infections

Strengths of the Study

This study has several strengths. First, it assessed both nurses' knowledge and **directly observed clinical practice**, providing a more comprehensive evaluation of infection prevention competency than studies relying solely on self-reported data. Second, each nurse was observed during three different work shifts, reducing the potential influence of shift-related variations and improving the reliability of the practice assessment. Third, the study was conducted in a specialized tertiary cardiac intensive care unit where adherence to evidence-based infection prevention measures is critical for patient safety, thereby providing valuable context-specific evidence for nursing practice and quality improvement.

Limitations of the Study

Several limitations should be considered when interpreting the findings. The study was conducted in a single tertiary cardiac intensive care unit with a relatively small sample size, which may limit the generalizability of the findings to other healthcare settings. In addition, the cross-sectional design precludes establishing causal relationships between nurses' knowledge and practice competency. Although direct observation provides a more objective assessment of clinical practice than self-report measures, participants' behavior may have been influenced by the possibility of being observed (Hawthorne effect). Future multicenter studies involving larger and more diverse samples are recommended to validate these findings and explore additional organizational and behavioral determinants of infection prevention practices.

Implications for Nursing Practice

The findings highlight the importance of maintaining continuous infection prevention education while recognizing that knowledge alone is insufficient to ensure consistent adherence to evidence-based practice. Healthcare organizations should complement educational programs with regular competency assessment, structured observational audits, timely performance feedback, and supportive leadership to strengthen compliance with infection prevention measures. Particular attention should be directed toward improving hand hygiene and urinary catheter care through targeted quality improvement initiatives, as these practices remain fundamental to reducing healthcare-associated infections in critical care settings.

6. CONCLUSION

The present study demonstrated that nurses working in the Adult Cardiac Intensive Care Unit possessed satisfactory knowledge and competent observed practices regarding infection prevention measures. Most participants achieved a good level of knowledge, while the remainder demonstrated fair knowledge, and overall clinical practice met the predetermined competency standard. Nevertheless, no statistically significant association was identified between nurses' knowledge level and observed practice competency, suggesting that clinical performance is influenced by factors beyond theoretical knowledge alone. These findings underscore the importance of integrating continuous professional education with organizational strategies that promote sustained adherence to evidence-based infection prevention practices. Strengthening institutional safety culture, implementing regular competency assessments, conducting observational audits, and providing constructive performance feedback may further enhance infection prevention compliance and contribute to reducing healthcare-associated infections among critically ill cardiac patients.

7. FINAL RECOMMENDATIONS

Based on the study findings, the following recommendations are proposed:

1. **Implement regular evidence-based infection prevention education** for critical care nurses to maintain current knowledge and reinforce adherence to international infection prevention guidelines.
2. **Conduct periodic competency assessments and observational audits** to monitor compliance with infection prevention practices and provide individualized performance feedback.
3. **Prioritize quality improvement initiatives targeting hand hygiene and urinary catheter care**, as these domains demonstrated comparatively lower compliance than other infection prevention practices.
4. **Strengthen organizational support for infection prevention** by ensuring adequate staffing, continuous availability of infection prevention resources, effective leadership engagement, and a positive patient safety culture.
5. **Undertake multicenter longitudinal studies** involving larger and more diverse critical care populations to evaluate the long-term relationship between nurses' knowledge, organizational factors, clinical practice, and healthcare-associated infection outcomes.

REFERENCES

[1] Batran, R., Ayed, A., Batran, A., Abu Ejheisheh, M., Alassoud, B., Hayek, M. F., & Batran, A. (2025). Determinants of nurses' compliance with infection prevention and control practices in critical care units. *SAGE Open Nursing, 11*, 23779608251339193. https://doi.org/10.1177/23779608251339193

[2] Buetti, N., Rupp, M. E., Marschall, J., Drees, M., Fakih, M. G., Hadaway, L., Maragakis, L. L., O'Grady, N. P., Yokoe, D. S., Monsees, E., & Healthcare Infection Control Practices Advisory Committee. (2022). Strategies to prevent central line-associated bloodstream infections in acute-care hospitals: 2022 update. *Infection Control & Hospital Epidemiology, 43*(5), 553–569. https://doi.org/10.1017/ice.2022.87

[3] Centers for Disease Control and Prevention. (2019). *Infection Control Assessment and Response (ICAR) tool for acute care hospitals.*

[4] Centers for Disease Control and Prevention. (2024). *Core infection prevention and control practices for safe healthcare delivery in all settings.*

[5] Centers for Disease Control and Prevention. (2024). *Clinical safety: Hand hygiene for healthcare personnel.*

[6] Erikson, E. J., Edelman, D. A., Brewster, F. M., Marshall, S. D., Turner, M. C., Sarode, V. V., & Brewster, D. J. (2023). The use of checklists in the intensive care unit: A scoping review. *Critical Care, 27*, 405. https://doi.org/10.1186/s13054-023-04758-2

[7] Glowicz, J. B., Landon, E., Sickbert-Bennett, E. E., Aiello, A. E., deKay, K., Hoffmann, K. K., Maragakis, L., Olmsted, R. N., Polgreen, P. M., Trexler, P. A., VanAmringe, M., Wood, A. R., Yokoe, D. S., & Ellingson, K. D. (2023). SHEA/IDSA/APIC practice recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 update. *Infection Control & Hospital Epidemiology, 44*(3), 355–376. https://doi.org/10.1017/ice.2022.304

[8] Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map? *Journal of Continuing Education in the Health Professions, 26*(1), 13–24. https://doi.org/10.1002/chp.47

[9] Kim, N., Gu, M., Cho, Y., Kim, O., & Sok, S. (2025). Factors influencing the performance of standard precautions for healthcare-associated infections by the nurses in intensive care units. *BMC Nursing, 24*, 243. https://doi.org/10.1186/s12912-025-02874-8

[10] Mouajou, V., Adams, K., DeLisle, G., & Quach, C. (2022). Hand hygiene compliance in the prevention of hospital-acquired infections: A systematic review. *Journal of Hospital Infection, 119*, 33–48. https://doi.org/10.1016/j.jhin.2021.09.016

[11] Raurell-Torredà, M., Aliberch-Asensi, A., Sánchez-Fidalgo, J., Torralba-Morón, M., Rojo-Rojo, A., Gómez-Romero, I., Farrés-Tarafa, M., et al. (2024). Design and content validation of a checklist about prevention performance of intensive care nurses in simulation-based scenarios. *Journal of Clinical Nursing, 33*, 3188–3198. https://doi.org/10.1111/jocn.17010

[12] Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

[13] World Health Organization. (2009). *WHO guidelines on hand hygiene in health care.* World Health Organization.

[14] World Health Organization. (2022). *Global report on infection prevention and control.* World Health Organization.

[15] World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA, 310*(20), 2191–2194. https://doi.org/10.1001/jama.2013.281053

[16] Yokoe, D. S., Advani, S. D., Anderson, D. J., Babcock, H. M., Bell, M., Berenholtz, S. M., Bryant, K., Buetti, N., Calderwood, M. S., Calfee, D. P., Deloney, V. M., Dubberke, E. R., Ellingson, K. D., Fishman, N. O., Gerding, D. N., Glowicz, J., Hayden, M. K., Kaye, K. S., … Meddings, J. (2023). Introduction to *A Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute-Care Hospitals: 2022 Updates*. *Infection Control & Hospital Epidemiology, 44*(10), 1533–1539. https://doi.org/10.1017/ice.2023.158