INTERNATIONAL JOURNAL OF ADVANCED RESEARCH
International Peer-Reviewed Research Journal
ISSN (Online): 3106-7980 | ISSN (Print): 3106-7972
Volume 3 • Issue 7 • November 2026

KNOWLEDGE AND COMPLIANCE OF ICU NURSES WITH CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTION PREVENTION GUIDELINES

Isaac Naseem[*1], Anabia Amer[2], Zunira Amir[3]

[*1,2]*Department of Nursing, Superior University, Lahore*
[3]*Supervisor, Department of Nursing, Superior University, Lahore*

[*1]Isaackhokhar23@gmail.com, [2]anabiaamer03@gmail.com, [3]zuniraAmir@gmail.com

DOI: https://doi.org/10.5281/zenodo.24078318

Keywords
Central Line-Associated Bloodstream Infection, CLABSI, Intensive Care Unit, Nurses, Knowledge, Attitude, Adherence, Evidence-Based Guidelines, Infection Prevention, Pakistan.

Article History
Received: 06 August 2026
Accepted: 20 October 2026
Published: 05 November 2026

Copyright @Author
Corresponding Author: *
Isaac Naseem

Abstract

Background: *Central Line-Associated Bloodstream Infection (CLABSI) is one of the most preventable healthcare-associated infections in intensive care units (ICUs). Nurses play a pivotal role in preventing CLABSI through adherence to evidence-based guidelines. Assessing nurses' knowledge, attitudes, and adherence is essential for identifying gaps that may affect patient safety.*

Aim: *To assess ICU nurses' knowledge, attitudes, and adherence to evidence-based guidelines for the prevention of Central Line-Associated Bloodstream Infection (CLABSI) at Services Hospital, Lahore.*

Methods: *A descriptive cross-sectional study was conducted among 80 ICU nurses selected through convenience sampling. Data were collected using a structured, self-administered questionnaire comprising demographic characteristics and validated measures of knowledge, attitude, and adherence. Data were analyzed using SPSS version 26. Descriptive statistics summarized participant characteristics and study variables, while Chi-square and Pearson's correlation tests were applied. Statistical significance was set at $p < .05$.*

Results: *Among the participants, 47.5% demonstrated good knowledge, 57.5% had a positive attitude, and 47.5% reported high adherence to evidence-based CLABSI prevention guidelines. Knowledge was significantly associated with educational qualification ($p = .015$), ICU experience ($p = .015$), and previous CLABSI training ($p = .006$). Attitude was significantly associated with previous CLABSI training ($p = .014$). Adherence was significantly associated with ICU experience ($p = .009$) and previous CLABSI training ($p = .004$).*

Conclusion: *ICU nurses demonstrated satisfactory knowledge, positive attitudes, and moderate to high adherence toward evidence-based CLABSI prevention. Continuous competency-based education, regular infection prevention training, and supportive institutional strategies are recommended to enhance adherence and improve patient safety.*

1. INTRODUCTION:

CLABSI is a major global concern among healthcare-associated infection for critically ill patients. CVCs are essential for the administration of certain medications, nutrition, and therapies. They also help with the monitoring of certain parameters. While beneficial, CVCs also put patients at risk of infection if insertion and maintenance methods are not done correctly. CLABSI contributes to antimicrobial resistance and added costs making its infection prevention a priority for patient safety. Prevention of CLABSI requires the adherence to aseptic techniques and continuous monitoring. There is a gap between evidence and implementation with many healthcare systems CLABSI prevention (Alqaissi, 2025; Hamdan et al., 2025).

1.1 BACKGROUND OF THE STUDY:

The burden of CLABSI presents a challenge to the economy and healthcare especially with patients in the ICU, who are at an even higher risk of infection, due to a higher degree of illness and immunosuppression, prolonged catheterization, and more invasive procedures. Because of the emphasis on prevention of CLABSI, many healthcare organizations across the globe have focused on implementation of continuous education, competent based training, and quality improvement for nursing practice. (Guan et al., 2025; Hamdan et al., 2025) Knowledge, attitude, and adherence are three interconnected aspects that impact a nurse's approach to infection prevention. For this reason, considering attitudes, knowledge, and adherence together is crucial to understanding the extent of a nurse's compliance to the CLABSI prevention guidelines (Kim & Roh, 2025, Badparva et al., 2023). The structured use of EBP, as demonstrated by the most recent implementation studies, is an effective way to achieve improved outcomes for CLABSI along with a decrease in infection rates (Guan et al., 2025). A systematic review conducted by Alqaissi (2025) reported that although most ICU nurses have a fair level of knowledge, there are gaps in knowledge and practice regarding catheter care and dressing as well as compliance to the CLABSI prevention bundle. Studies in Jordan, Saudi Arabia, Iran, and Korea have all reported fair knowledge but scant compliance to recommended practice, although a positive attitude toward the prevention of infection was evident. It is clear from these studies that knowledge does not lead to compliance in practice, and there may be other organizational and behavioral factors involved(Shakeel et al., 2025). Badparva et al. (2023) stated that perceived barriers to prevention practice are one of the most important predictors of nurses' prevention practice, while Kim and Roh (2025) demonstrated that perceived barriers explain the gap between knowledge and prevention practice. Recent studies focusing on nurses from ICU and dialysis units stressed the importance of designing and implementing tailored, competency-based education and periodic assessments to maintain adherence to infection prevention practices (Qtait et al.). Shaukat (2026) found moderate CLABSI prevention knowledge, attitudes, and adherence of ICU nurses in Lahore. CLABSI prevention studies focusing on research, education, evidence-based protocols, training scheduled with a focus on competencies, and the use of ongoing audits have shown positive results to nursing practice (Zahra & Elhosieny, 2025; Guan et al., 2025). When different, evidence-based, and systematic approaches that focus on care bundles, leadership, and feedback are used, results are shown to be more beneficial than a single focus on education (Hamdan et al., 2025). A lot of research in Pakistan is limited to cross-sectional studies that are often done in a single center, which results in a small sample size that is not easily generalizable. This research addresses a significant knowledge gap by providing evidence in an area that will support nursing practice and management in healthcare systems and the implementation of infection control measures related to central line-associated bloodstream infections.

1.2. PROBLEM STATEMENT:

The Central line associated bloodstream infection (CLABSI) is an example of a healthcare-associated

infection that is both complex and extremely difficult to deal with. Nurses are the main line of defense in the fight against CLABSI because they are the most likely to be the ones to change the catheters and administer medication.

Commonly accepted knowledge in the literature shows that while many CLABSI prevention related ICU nurses have a moderate understanding of the ailment, there is a considerable absence of adherence to related practices because of a lack of education, and a lack of the skills to carry out the practice, a heavy workload, and inadequate support from the hospital (insert author, 2022, 2023, 2023, 2024). Recent systematic reviews of the literature have acknowledged the disparity in the CLABSI prevention knowledge that exists among nurses, and preventive behaviors among nurses, calling for evidence in the respective fields (insert author, 2025, 2025).

In Pakistan, there is a lack of published data on ICU nurses' knowledge, attitudes, and evidence-based guidelines for CLABSI prevention. Most studies have been on small samples in a handful of institutions and have focused on either knowledge or compliance. There has not been an assessment of all three concepts. Also, differences in healthcare systems and services on a global scale, such as staffing and infection prevention resources as well as continuing professional education, affect the applicability of overseas research on the Pakistan healthcare system (Yaseen et al., 2022; Shaukat, 2026).

The absence of evidence in Pakistan creates a significant void in understanding how prepared ICU nurses are to defend evidence-based CLABSI prevention. This study therefore aims to investigate ICU nurses' knowledge, attitudes, and adherence toward evidence-based CLABSI prevention. This research is expected to defend evidence-based interventions in the Pakistan context to advance nursing practice and to provide support to CLABSI prevention in ICU.

1.3. OPERATIONAL DEFINITIONS:

Central Line-Associated Bloodstream Infection (CLABSI)

Central Line-Associated Bloodstream Infection (CLABSI) is a laboratory-confirmed bloodstream infection that develops in a patient with a central venous catheter (CVC) in place for more than 48 hours before the onset of infection, with no other identifiable source of infection. In this study, CLABSI refers to the healthcare-associated infection that evidence-based nursing practices aim to prevent.

Intensive Care Unit (ICU) Nurse

An ICU nurse is a registered nurse working in an adult Intensive Care Unit (ICU) who provides direct patient care and is involved in the insertion assistance, maintenance, monitoring, and removal of central venous catheters. Nurses with at least **six months of ICU experience** will be eligible to participate.

Knowledge

Knowledge refers to ICU nurses' understanding of evidence-based guidelines for preventing CLABSI, including hand hygiene, maximal sterile barrier precautions, skin antisepsis, catheter site care, dressing changes, catheter hub disinfection, and timely catheter removal.

Knowledge will be assessed using a structured questionnaire consisting of **20 multiple-choice items**. Each correct response will receive **1 mark**, while an incorrect or "don't know" response will receive **0 marks**. The total knowledge score will range from **0 to 20**.

Knowledge Score Grading

- **Good Knowledge:** 16–20 (≥80%)
- **Moderate Knowledge:** 12–15 (60–79%)
- **Poor Knowledge:** 0–11 (<60%)

Attitude

Attitude refers to ICU nurses' beliefs, perceptions, and willingness to comply with evidence-based CLABSI prevention guidelines.

Attitude will be measured using **10 statements** rated on a **5-point Likert scale** ranging from **1 =**

Strongly Disagree to **5 = Strongly Agree**. The total attitude score will range from **10 to 50**.

Attitude Score Grading

- **Positive Attitude:** 40–50 (≥80%)
- **Neutral Attitude:** 30–39 (60–79%)
- **Negative Attitude:** 10–29 (<60%)

Adherence

Adherence refers to the extent to which ICU nurses consistently implement evidence-based CLABSI prevention guidelines during routine clinical practice.

Adherence Score Grading

- **High Adherence:** 60–75 (≥80%)
- **Moderate Adherence:** 45–59 (60–79%)
- **Low Adherence:** 15–44 (<60%)

Evidence-Based Guidelines

Evidence-based guidelines refer to standardized recommendations for CLABSI prevention developed by recognized organizations such as the **Centers for Disease Control and Prevention (CDC)**, **Infusion Nurses Society (INS)**, and the **Society for Healthcare Epidemiology of America (SHEA)**. These guidelines provide the benchmark against which nurses' knowledge and adherence will be evaluated.

1.4. OBJECTIVES OF THE STUDY:

To assess intensive care unit (ICU) nurses' knowledge, attitude, and adherence to evidence-based guidelines for the prevention of Central Line-Associated Bloodstream Infection (CLABSI).

1.5. AIM OF THE STUDY:

The aim of this study is to assess intensive care unit (ICU) nurses' knowledge, attitude, and adherence to evidence-based guidelines for the prevention of Central Line-Associated Bloodstream Infection (CLABSI).

1.6. RESEARCH QUESTION OF THE STUDY:

What are the levels of knowledge, attitude, and adherence to evidence-based guidelines for the prevention of Central Line-Associated Bloodstream Infection (CLABSI) among intensive care unit (ICU) nurses?

3. METHODOLOGY

The study took place at Services Hospital, Lahore, a public-sector, tertiary care, teaching hospital in Punjab, Pakistan. A descriptive cross-sectional study design was employed to assess intensive care unit (ICU) nurses' knowledge, attitude, and adherence to evidence-based guidelines for the prevention of Central Line-Associated Bloodstream Infection (CLABSI). The population of this study was the registered nurses working in the adult ICUs of Services Hospital, Lahore. The study sample consisted of 80 ICU nurses. The Raosoft Online Sample Size Calculator was used to calculate sample size with the following assumptions: total ICU nurses =100, confidence level = 95%, margin of error = 5%, and response distribution = 50%. A convenience sampling technique was used to select participants who met the inclusion criteria and were available during the data collection period. Prior to commencing the research, ethical approval was obtained from the Institutional Review Board (IRB). Written informed consent was obtained. Data collection involved a structured, self-administered questionnaire. The questionnaire was designed with four sections. The first section covered the socio-demographic characteristics of the participants. The remaining sections covered participants' knowledge, attitudes, and adherence to evidence-based CLABSI prevention practices. Anonymity was maintained throughout the study. Data were entered, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0 after being cleaned. The Chi-square test as an association test was used to relate categorical variables and selected socio-demographic variables. A p-value of 0.05 was taken as significant.

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH
International Peer-Reviewed Research Journal
ISSN (Online): 3106-7980 | ISSN (Print): 3106-7972
Volume 3 • Issue 7 • November 2026

4 RESULTS AND ANALYSIS:

Table 4.1

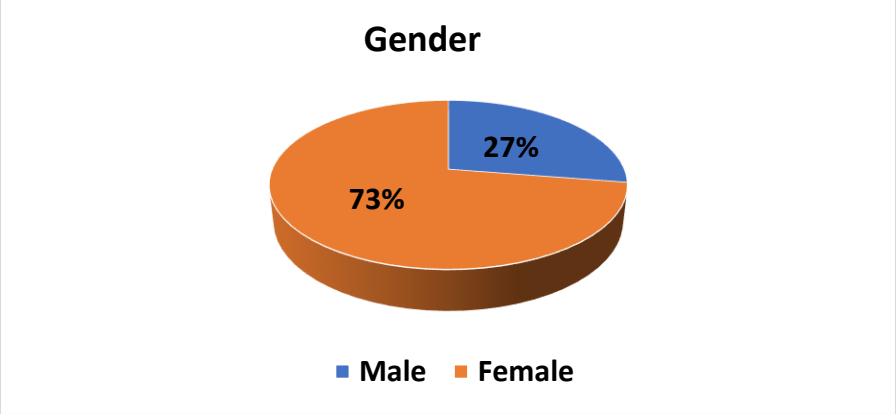
Demographic Characteristics of ICU Nurses (N = 80)

Variable	Category	n	%
Age (years)	20–29	32	40.0
	30–39	35	43.8
	≥40	13	16.2
Gender	Male	22	27.5
	Female	58	72.5
Qualification	Diploma	17	21.3
	Generic BSN	31	38.7
	Post RN BSN	23	28.8
	MSN/ MPH	9	11.2
ICU Experience	6 months–2 years	20	25.0
	3–5 years	34	42.5
	>5 years	26	32.5
Previous CLABSI Training	Yes	48	60.0
	No	32	40.0

International Journal of Advanced Research

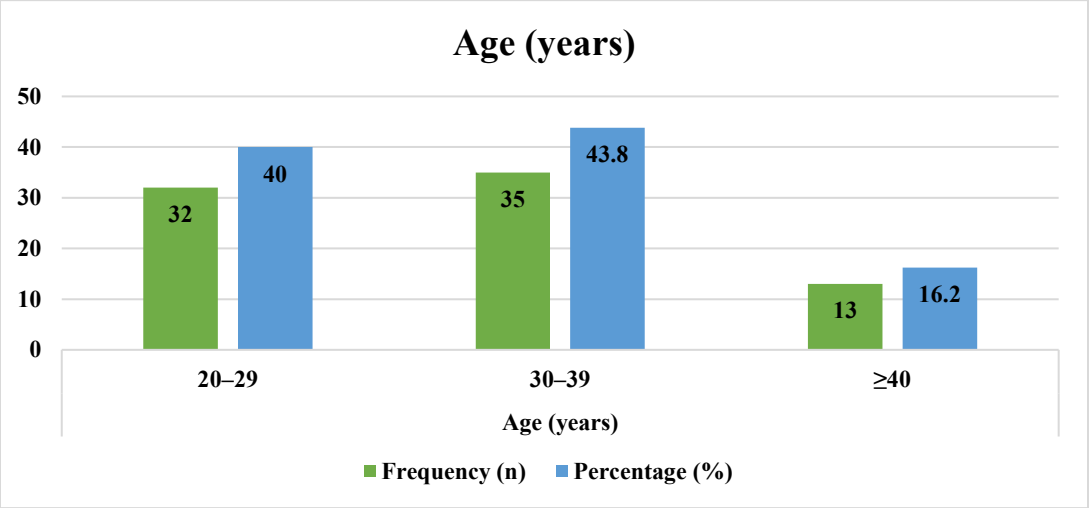
Table 4.1 presents the demographic characteristics of the 80 ICU nurses included in the study. The findings show that the largest proportion of participants (43.8%) were aged between 30 and 39 years, followed by 40.0% aged 20–29 years, while only 16.2% were aged 40 years or above, indicating that the majority of respondents were young to middle-aged nurses. Female nurses constituted nearly three-quarters (72.5%) of the study population, whereas male nurses accounted for 27.5%. Regarding educational qualifications, most participants held a Generic BSN degree (38.7%), followed by Post RN BSN (28.8%), Diploma (21.3%), and MSN/MPH (11.2%). In terms of ICU experience, 42.5% of nurses had 3–5 years of experience, 32.5% had more than five years, and 25.0% had 6 months to 2 years of experience. Additionally, 60.0% of the participants reported having received previous CLABSI prevention training, while 40.0% had not, suggesting that the majority had prior exposure to infection prevention education relevant to evidence-based CLABSI prevention practices.

Figure 4.1. Gender Distribution of Participants



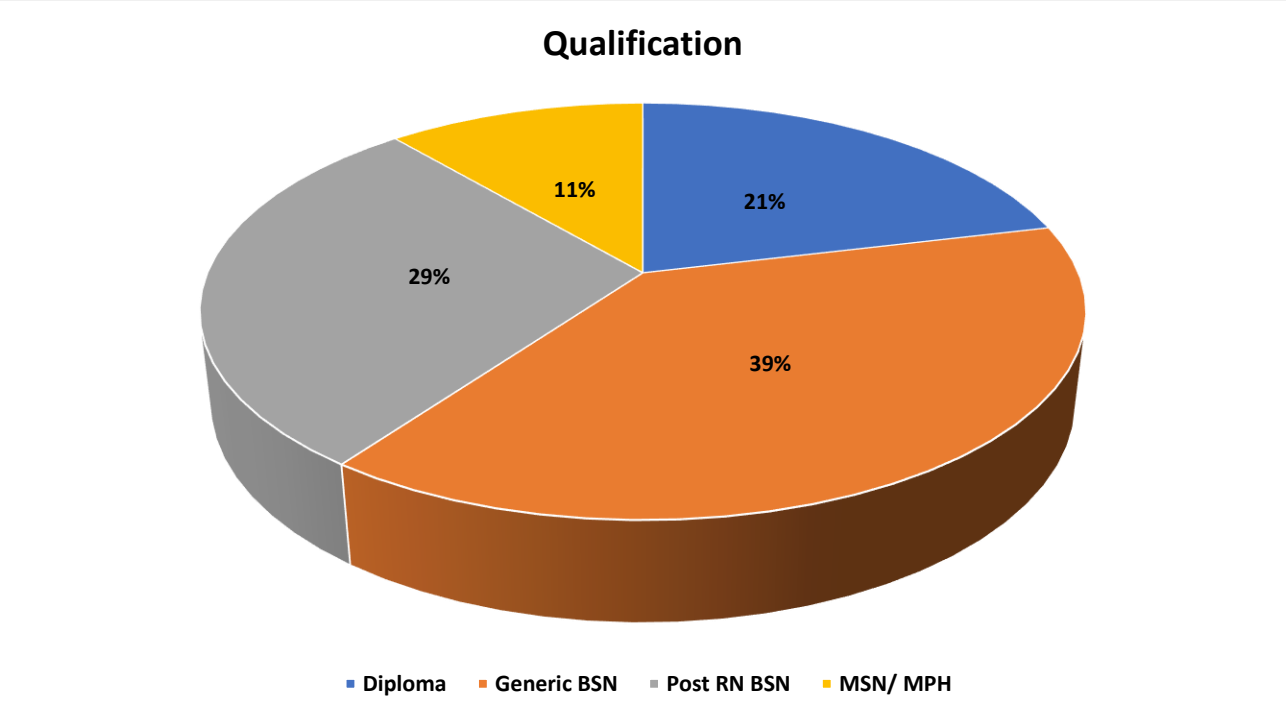
The majority of participants were female nurses (72.5%), while male nurses accounted for 27.5% of the study sample.

Figure 4.2. Age of Participants



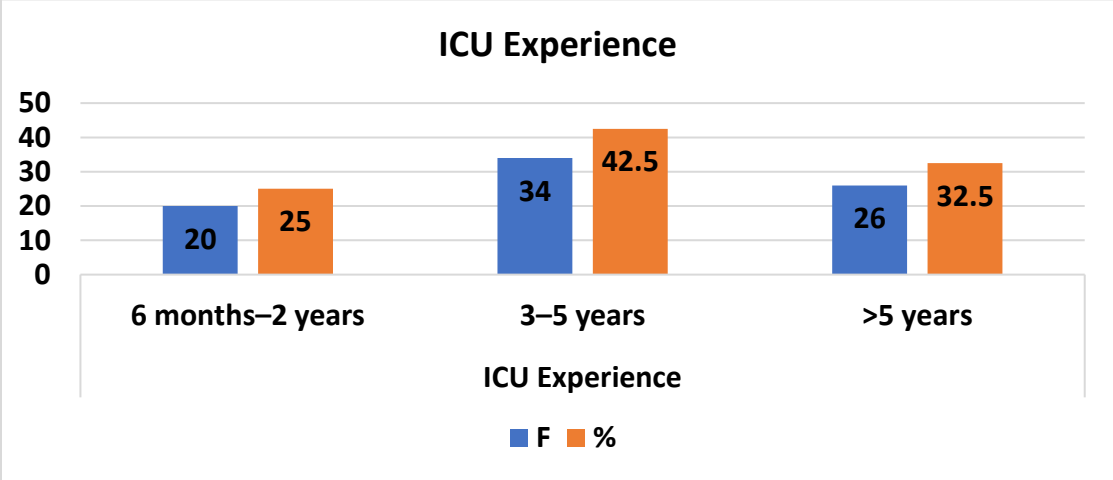
Most nurses were aged 30–39 years (43.8%), followed by those aged 20–29 years (40.0%). A smaller proportion of participants were aged 40 years and above (16.2%), indicating fewer older nurses in the sample.

Figure 4.3. Qualification



Most participants held a **Generic BSN degree** (38.7%), followed by **Post RN BSN** (28.8%), **Diploma** (21.3%), and **MSN/MPH** (11.2%). This indicates that the majority of ICU nurses possessed undergraduate nursing qualifications.

Figure 4.4 ICU Experience



The largest proportion of nurses (**42.5%**) had **3–5 years** of ICU experience, while **32.5%** had more than five years and **25.0%** had 6 months to 2 years of experience. Overall, most participants had sufficient clinical experience in intensive care settings.

Figure 4.5 Previous CLABSI Training



A majority of the nurses (**60.0%**) had previously received training on CLABSI prevention, whereas **40.0%** had not attended any formal training. This suggests that although most participants had exposure to infection prevention education, a substantial proportion still lacked formal CLABSI-specific training.

Table 4.2 Knowledge of ICU Nurses Regarding Evidence-Based CLABSI Prevention (N = 80)

Knowledge Category	Score	n	%
Poor	<60%	10	12.5
Moderate	60–79%	32	40.0
Good	≥80%	38	47.5

Table 4.2 illustrates ICU nurses' knowledge regarding evidence-based guidelines for the prevention of Central Line-Associated Bloodstream Infection (CLABSI). Nearly half of the participants (47.5%) demonstrated good knowledge, while 40.0% had moderate knowledge and only 12.5% exhibited poor knowledge. The mean knowledge score was 78.8 ± 10.4, with scores ranging from 48 to 98. These findings suggest that although the majority of ICU nurses possessed satisfactory knowledge of CLABSI prevention guidelines, a considerable proportion still demonstrated only moderate or poor knowledge. This highlights the need for ongoing educational initiatives and competency-based training to strengthen nurses' understanding and ensure consistent implementation of evidence-based infection prevention practices.

Table 4.3 Attitude of ICU Nurses Toward Evidence-Based CLABSI Prevention (N = 80)

Attitude Category	Score	n	%
Negative	<60%	8	10.0
Neutral	60–79%	26	32.5
Positive	≥80%	46	57.5

Table 4.3 presents ICU nurses' attitudes toward evidence-based CLABSI prevention guidelines. The findings reveal that more than half of the respondents (57.5%) demonstrated a positive attitude, whereas 32.5% exhibited a neutral attitude and only 10.0% had a negative attitude. The mean attitude score was 82.6 ± 8.7, with individual scores ranging from 56 to 98. These results indicate that most ICU nurses recognized the importance of adhering to evidence-based CLABSI prevention practices and were positively inclined toward implementing recommended infection control measures. Nevertheless, the presence of neutral and negative attitudes among some participants suggests that continuous motivation, professional development, and institutional support are required to further strengthen positive attitudes toward patient safety and infection prevention.

Table 4.4 Adherence of ICU Nurses to Evidence-Based CLABSI Prevention Guidelines (N = 80)

Adherence Category	Score	n	%
Low	<60%	12	15.0
Moderate	60–79%	30	37.5
High	≥80%	38	47.5

Table 4.4 summarizes ICU nurses' adherence to evidence-based CLABSI prevention guidelines. The findings demonstrate that 47.5% of nurses reported high adherence to recommended preventive practices, while 37.5% exhibited moderate adherence and 15.0% had low adherence. The mean adherence score was 80.2 ± 9.5, with scores ranging from 52 to 98. These results indicate that although nearly half of the participants consistently followed evidence-based CLABSI prevention guidelines, more than half demonstrated moderate or low adherence. This suggests opportunities for improving compliance through regular clinical audits, competency

assessments, refresher training, and strengthened organizational support for evidence-based nursing practice.

Table 4.5 Association Between Knowledge and Selected Demographic Variables

Variable	χ^2	df	p
Age	8.94	6	.177
Gender	2.14	2	.343
Qualification	15.82	6	.015
ICU Experience	12.37	4	.015
Previous CLABSI Training	10.21	2	.006

Table 4.5 presents the association between ICU nurses' knowledge regarding CLABSI prevention and selected demographic variables. The findings indicate that educational qualification (χ^2 = 15.82, p = .015), ICU experience (χ^2 = 12.37, p = .015), and previous CLABSI training (χ^2 = 10.21, p = .006) were significantly associated with knowledge levels. These results suggest that nurses with higher educational qualifications, greater clinical experience, and previous infection prevention training possessed better knowledge regarding evidence-based CLABSI prevention guidelines. Conversely, no statistically significant associations were observed between knowledge and age or gender, indicating that these characteristics did not substantially influence nurses' knowledge levels in the present study.

International Journal of Advanced Research

Table 4.6 Association Between Attitude and Selected Demographic Variables

Variable	χ^2	df	p
Age	5.73	6	.454
Gender	1.69	2	.430
Qualification	8.91	6	.179
ICU Experience	6.38	4	.172
Previous CLABSI Training	8.54	2	.014

Table 4.6 illustrates the association between ICU nurses' attitudes toward evidence-based CLABSI prevention and selected demographic characteristics. The analysis revealed that previous CLABSI training was the only variable significantly associated with nurses' attitudes (χ^2 = 8.54, p = .014). Nurses who had received previous infection prevention training demonstrated more positive attitudes toward implementing evidence-based CLABSI prevention practices. In contrast, no statistically significant associations were identified between attitude and age, gender, educational qualification, or ICU experience. These findings suggest that structured educational and training programs play an important role in fostering positive professional attitudes toward infection prevention.

Table 4.7 Association Between Adherence and Selected Demographic Variables

Variable	χ^2	df	p
Age	6.85	6	.335
Gender	2.27	2	.321
Qualification	11.68	6	.070

ICU Experience	13.42	4	.009
Previous CLABSI Training	11.14	2	.004

Table 4.7 shows the association between ICU nurses' adherence to evidence-based CLABSI prevention guidelines and selected demographic variables. The findings indicate statistically significant associations between adherence and ICU experience (χ^2 = 13.42, p = .009) as well as previous CLABSI training (χ^2 = 11.14, p = .004). Nurses with greater ICU experience and those who had previously attended CLABSI prevention training demonstrated significantly higher adherence to evidence-based guidelines. However, no statistically significant associations were found between adherence and age, gender, or educational qualification. These findings emphasize the importance of clinical experience and continuous professional education in promoting consistent adherence to evidence-based infection prevention practices among ICU nurses.

5 DISCUSSIONS OF THE STUDY:

The current study revealed that almost half of the participants possessed strong knowledge of the evidence-based CLABSI prevention guidelines and that a smaller proportion of respondents displayed poor knowledge. He et al. (2025) reported similar findings, showing satisfactory knowledge of prevention among Chinese ICU nurses based on a validated knowledge, attitude, and practice tool. Tomazeh et al. (2025) reported moderate to good knowledge of central line care among ICU nurses. Ramadan Ahmed and Gad Allah (2026) found that infection prevention training attendance impacted knowledge and compliance. Zahra and Elhosieny (2025) found that conducting infection prevention training improved attitudes toward infection prevention among nurses and their willingness to adopt infection prevention. Dang et al. (2023) also found that training led to positive attitudes, and that education and training are more important than demographics in impacting attitudes. Similar results were described by He et al. (2025) who stated that ICU nurses had a positive attitude toward evidence-based catheter care and evidence-based infection prevention. The current study showed that close to 50% of the sample had a high level of adherence to CLABSI prevention methods, while a significant number of the sample had a moderate level of adherence. These findings were similar to those of Singh et al. (2024) who stated that while nurses had an understanding of central line bundles, the full bundling was not implemented in several clinical areas. Likewise, Rajandra et al. (2025) stated that the occurrence of CLABSI in ICU was related to compliance with evidence-based central line care bundles. Eldessouki et al. (2026) reported similar results, showing that improvement in nurses' clinical practices and reduction in CLABSI cases were directly impacted by educational interventions. Şanlı et al. (2023) showed similar results when an evidence-based nursing care model was practiced.

6 CONCLUSION AND RECOMMENDATIONS OF THE STUDY:

The present study assessed ICU nurses' knowledge, attitude, and adherence to evidence-based guidelines for the prevention of Central Line-Associated Bloodstream Infection (CLABSI) at Services Hospital, Lahore. The findings demonstrated that most ICU nurses possessed good knowledge, positive attitudes, and moderate to high adherence toward evidence-based CLABSI prevention practices. Educational qualification, ICU experience, and previous CLABSI prevention training were significantly associated with nurses' knowledge, while previous training significantly influenced nurses' attitudes. These findings emphasize that continuous professional education and practical clinical experience are essential for improving compliance with evidence-based infection prevention practices. Regular competency-based educational and refresher training programs on evidence-based CLABSI prevention should be organized for ICU nurses.

Hospital infection prevention and control committees should conduct periodic clinical audits and provide constructive feedback to improve adherence to CLABSI prevention guidelines. Nurse managers should establish routine competency assessments and supportive supervision to ensure consistent implementation of evidence-based practices. Future multicenter studies with larger sample sizes should be conducted to improve the generalizability of the findings across different healthcare institutions in Pakistan. The use of a structured and validated questionnaire enhanced the reliability and consistency of data collection. The cross-sectional study design limited the ability to establish causal relationships between study variables. The study was conducted at a single tertiary care hospital using a convenience sampling technique, which may limit the generalizability of the findings to other healthcare settings. Data were collected through self-administered questionnaires; therefore, participants' responses may have been influenced by recall bias or social desirability bias. Actual adherence to CLABSI prevention guidelines was not assessed through direct clinical observation, and institutional factors such as workload, staffing levels, availability of supplies, and organizational culture were not evaluated.

REFERENCES:

Alkhaibari, S. S. A., Alkhaibari, E. S. A., & Alzahrani, T. A. S. Compliance of Central Line-Associated Bloodstream Infection Prevention Guidelines Among Registered Nurses in Intensive Care Units.

Almalki, A. I., Alghamdi, H. A., Tashkandy, N. A., & Tashkandy, N. (2023). Assessment of knowledge, attitude, and adherence to national guidelines for preventing central line-associated bloodstream infections among ICU nurses of adult patients in Jeddah, Saudi Arabia: A cross-sectional survey. *Cureus, 15*(7).

Alqalah, T. A. H. (2024). Mitigating risks in central line-associated bloodstream infection: A comprehensive insight into critical care nurses' knowledge, attitudes, barriers, and compliance. *BMC Nursing, 23*(1), 497.

Alqaissi, N. (2025). Nurses' knowledge and behavior in hospitals regarding the prevention of central line-associated bloodstream infections: A systematic review. *SAGE Open Nursing, 11*, 23779608251347119.

Amanya, L., Atuhaire, E., & Nyakuri, E. (2026). Nurses' knowledge and practices on prevention of central line associated blood stream infections at a national referral hospital in Uganda. *International Journal of Critical Care, 20*(2), 47–63.

Badparva, B., Ghanbari, A., Karkhah, S., Osuji, J., Kazemnejad Leyli, E., & Jafaraghaee, F. (2023). Prevention of central line-associated bloodstream infections: ICU nurses' knowledge and barriers. *Nursing in Critical Care, 28*(3), 419–426.

Dang, F., Zhai, T., Ding, N., Gao, J., Li, R., Li, H., & Ran, X. (2023). Development and validation of a questionnaire to measure ICU nurses' knowledge, attitudes, and practices related to central line bloodstream infection practices. *Journal of Nursing Care Quality, 38*(4), E59–E65.

Eldessouki, S. M. A., Elmetwaly, A. A. M., & Hassanein, A. A. (2026). Assessment of nurses' knowledge, practice and infection rate of central line associated blood stream infection. *Mansoura Nursing Journal, 13*(1).

Guan, S., Pang, D., Li, J., Ge, H., Wang, X., Yuan, C., ... & Yang, H. (2025). Evidence-based practice for preventing central line-associated bloodstream infections in intensive care units: An implementation study. *Interdisciplinary Nursing Research, 4*(4), 191–199.

Hamdan, D. B., Hatahet, S., Khalil, H., & Yousef, K. M. (2025). Strategies to enhance nurses' adherence to central line-associated bloodstream infection prevention bundles in the ICU setting: A systematic review. *Heart & Lung, 71*, 98–105.

He, X., Li, C., Wang, Z., Yang,M., Zhou, T., Gu, Y., ... & Hu, Y. (2025). Knowledge, attitude and practice concerning central line-associated bloodstream infection prevention among ICU nurses in China: A multicenter, cross-sectional study. *Nursing in Critical Care, 30*(3), e70047.

Kim, M., & Roh, Y. S. (2025). Knowledge and self-reported practices in central line-associated bloodstream infection prevention among nurses: The mediating effect of perceived barriers. *Nursing in Critical Care, 30*(6), e70253.

Matlab, A. A., Al-Hussami, M. O., & Alkaid Albqoor, M. (2022). Knowledge and compliance to prevention of central line-associated blood stream infections among registered nurses in Jordan. *Journal of Infection Prevention, 23*(4), 133–141.

Qtait, M., Alqaissi, N., & Jaradat, Y. (2025). Assessment of nurses' knowledge and behavior toward preventing central line-associated bloodstream infections in intensive care units and dialysis units. *SAGE Open Nursing, 11*, 23779608251402958.

Rajandra, A., Yunos, N. A. M., Teo, C. H., Kukreja, A., Suhaimi, N. A., Mohd Razali, S. Z., ... & Ponnampalavanar, S. S. L. S. (2025). Incidence, compliance, and risk factor associated with central line-associated bloodstream infection (CLABSI) in intensive care unit (ICU) patients: A multicenter study in an upper middle-income country. *Antibiotics, 14*(3), 271.

Ramadan Ahmed, H. S., & Gad Allah, R. M. (2026). Evaluation of nursing knowledge and compliance in neonatal intensive care unit (NICU) regarding central line associated blood stream infection. *Egyptian Journal of Nursing and Health Sciences, 7*(2), 34–49.

Şanlı, D., Sarıkaya, A., & Pronovost, P. J. (2023). Effects of the care given to intensive care patients using an evidence model on the prevention of central line-associated bloodstream infections. *International Journal for Quality in Health Care, 35*(4), mzad104.

Sham, F., Sulaiman, N. H., Seman, A., Shohor, N. A., & Mun, C. Y. (2023). Intensive care nurses' knowledge, practice and attitude in prevention of central line-associated bloodstream infection (CLABSI). *Journal of Health and Translational Medicine (JUMMEC)*, 102–110.

Shaukat, K. (2026). ICU nurses' knowledge, attitude, and adherence to evidence-based guidelines for the prevention of central line-associated bloodstream infection: A study of Shaikh Zayed Hospital, Lahore. *Journal of Pharma and Biomedics, 4*(1), 125–132.

Singh, S., Sharma, A., Dhawan, M., & Sharma, S. P. (2024). Assessment of the level of awareness and degree of implementation of central line bundles for prevention of central line-associated blood stream infection: A questionnaire-based observational study. *Indian Journal of Critical Care Medicine, 28*(9), 847.

Tomazeh, F., Issa, M. M., Atrash, A. Y. A., Greeab, H. M., Tous, A. M., & Maree, M. A. (2025). Nurses' knowledge toward preventing central line-associated bloodstream infections in intensive care units. *Nursing Depths Series, 4*, 283.

Yaseen, M., Suliman, M., Yaseen, M., Ali, S., & Sultan, A. (2022). Knowledge and compliance regarding central line associated blood stream infections (CLABSIs) prevention among public and private hospital intensive care unit nurses: Central line associated blood stream infections. *The Therapist (Journal of Therapies & Rehabilitation Sciences)*, 15–19.

Zahra, E. M., & Elhosieny, S. (2025). Training nursing staff on infection control guideline to prevent central line-associated bloodstream infection. *Mansoura Nursing Journal, 12*(2)

Shakeel, A., Naveed, M., Raza, M. A., Bashir, S., Jahangir, A., Hakeem, S., & Fazil, M. S. (2025). Comparative Efficacy of Alpha Guard and Formalin Fumigation in Reducing Microbial Contamination in Operation Theater: A Pre-and Post-Intervention Cross-Sectional Analysis from a Tertiary Care Hospital. *Journal of Medical & Health Sciences Review, 2*(4).

International Journal of Advanced Research