

KNOWLEDGE, ATTITUDES, AND PRACTICE: A TRIPARTITE ANALYSIS OF CLABSI PREVENTION BUNDLES AMONG INTENSIVE CARE UNIT NURSES IN TERTIARY CARE HOSPITALS OF KARACHI

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Abstract

In critical care units (ICUs), central line-associated bloodstream infections (CLABSIs) are a recurring problem, particularly in resource-constrained healthcare environments. Even though there are prevention bundles based on clinical guidelines, uneven implementation is still an issue. As the main medical professionals in charge of central lines, nurses are essential in making sure that these procedures are followed. Variations in their comprehension and knowledge, however, could affect compliance. The purpose of this study was to evaluate how ICU nurses' awareness affects their adherence to CLABSI prevention bundles in Karachi's tertiary care hospitals. Sixty intensive care unit nurses participated in a descriptive, cross-sectional study. Twenty items in a structured questionnaire assessed respondents' compliance and understanding of CLABSI prevention. IBM SPSS version 21 was used for data analysis. Pearson's correlation evaluated the relationship between the variables, Cronbach's alpha tested reliability ($\alpha = 0.735$), and descriptive statistics summarized the data. The analysis showed, participants' mean knowledge score was 35.09 (SD = 4.45), and their mean compliance score was 45.50 (SD = 6.09). Knowledge and compliance were found to be strongly positively correlated ($r = 0.827$, $p < 0.001$), suggesting that better adherence to infection control procedures is substantially correlated with greater knowledge. The study's conclusion emphasizes how critical it is to increase nurses' understanding in order to support the successful application of CLABSI prevention techniques. In intensive care units, consistent monitoring, institutional support, and educational efforts may boost patient safety and compliance.

INTRODUCTION

Patient safety is of utmost importance in the healthcare industry, particularly in the critical care environment because of the severity of patient conditions and the complexity of care (Atalla, 2025). The goal of patient safety in

critical care is to reduce risks, stop injuries, and enhance the general standard of care for patients with life-threatening illnesses (Shi, 2025). In addition to guaranteeing efficient communication and coordination between

healthcare providers, this entails reducing unfavorable outcomes like infections, prescription errors, and equipment malfunctions. Because of the severity of the patients' diseases, the intricacy of the therapies, and the quick decision-making process, critical care units are by nature high-risk settings (Alruwaili, 2025). Critical care mistakes can have serious repercussions, including death or permanent disability (Shibahashi, 2025). Errors are more likely to occur when critical care patients need complicated interventions, several drugs, and ongoing monitoring (Zampieri, 2025). In critical care, putting patient safety first directly improves patient outcomes, such as lower rates of death, morbidity, and quicker recovery.

CLABSI is a primary laboratory-confirmed bloodstream infection that is unrelated to an infection from another site and occurs in a patient who has a central line at the time of (or within 48 hours before) the development of symptoms (Yang, 2025). Because of their substantial influence on patient outcomes and medical expenses, central line-associated bloodstream infections, or CLABSI, are a major issue in intensive care units (ICUs). They can result in longer hospital admissions, higher death rates, and significant financial strains on healthcare systems (Mosquera, 2024). They are also a leading cause of hospital-acquired infections. An increased risk of death is linked to CLABSIs; according to certain research, the odds ratio for in-hospital death can reach 2.75 (Elangovan, 2024; Alomari, 2025; Karagiannidou, 2024).

CLABSI make it harder for critically ill individuals to recover by increasing their morbidity, or disease and problems. Longer hospital stays are common for patients with CLABSIs, which raises healthcare expenses and utilization (Sabo, 2024). Each CLABSI case can have a significant additional cost; according to some research, this cost is approximately \$46,000 (Riley, 2024). In already overcrowded intensive care units, these infections can put a burden on medical resources and lead to a shortage of beds. CLABSIs can greatly raise the overall financial burden on healthcare systems and are a leading cause of hospital-acquired infections (Bohan, 2024). Improving patient safety, allocating resources optimally, and

managing healthcare expenses all depend on lowering CLABSI rates (Lim, 2024). With the right aseptic procedures, monitoring, and management plans, the majority of CLABSIs can be avoided (Guerrero-Díaz, 2024). To lower the incidence of CLABSIs, evidence-based recommendations for central line installation and maintenance—like those offered by the CDC—are crucial (Baldauf, 2025). These recommendations cover things like washing your hands, preparing your skin with chlorhexidine, and using full-barrier measures while inserting a catheter. CLABSI rates must be continuously monitored and observed to pinpoint areas that require improvement and assess how well preventative initiatives are working (Mostafa, 2022). To lower the frequency of CLABSIs, hospitals and intensive care units should employ a variety of methods, including as staff education, the use of checklists, and the timely removal of unneeded catheters (Beville, 2021).

In intensive care units (ICUs), central line-associated bloodstream infections (CLABSIs) are an enormous burden which elevates morbidity, mortality, gets longer hospital stays, and increases up healthcare costs generally (Sikka, 2024). Globally, the incidence of CLABSI is thought to be around 0.8 per 1,000 central line days in high-income settings, although it can vary widely within 1.5 and significantly more than 17 per 1,000 days in low- and middle-income nations, including Pakistan (Rajandra, et al., 2025). By correctly placing, maintaining, and removing central lines, nurses play a crucial part in preventing them. Reducing these infections and improving patient care can be achieved by providing nurses with frequent training and adhering to updated standards. Globally, CLABSI cases have decreased, but in ICU settings of developing countries, it is still a common problem. Chinese intensive care unit nurses lacked awareness and a negative attitude on CLABSI prevention. According to (He, et al., 2025) nurses' knowledge and practices can be enhanced by training, assistance from seasoned nurses, and a stronger safety culture.

The primary approach for preventing CLABSIs are bundled interventions, which include evidence-based components including strict hand cleanliness, maximal sterile barrier

actions, chlorhexidine skin antisepsis, acceptable catheter site selection, and frequent requirement assessment. According to meta-analyses and multicenter studies, observing these bundles greatly reduces infection rates in many kinds of resource events (Rajandra, et al., 2025). Multicenter research conducted in Malaysia, for instance, showed that the overall compliance rate was 65% and the CLABSI rate was 4.16 per 1,000 catheter days (Rajandra, et al., 2025). while CLABSI rates in Bahrain's 4-year intensive care unit tracking program decreased from 4.7 to 1.4 per 1,000 days following the adoption of a protective bundle (Al-Khawaja, Saeed, Alkhawaja, Azzam, & Al-Biltagi, 2021). One of the most significant issues in intensive care units (ICUs) around the world is central-line-associated bloodstream infection (CLABSI). In January 2010, a 13-bed medical/surgical intensive care unit in Kocaeli, Turkey, implemented a set of CLABSI care methods. Measured from the start of the third quarter of 2010 to June 2013, rates of compliance with the bundle were compared to CLABSI rates. 732 lines were inserted for 4366 line-days of monitoring in 2196 intensive care unit patients across the post-intervention period (Sumrall, 2022). Staff feedback improved the ICU's patient safety culture. For 38 months following introduction, there were zero infections (Alanazi, 2023).

Tripathi (2023) found that during the study, hospitals reported 27 196 CLABSI on 20 274 565 line days (1.34 CLABSI/1000 line days). 2 085 700 (84%) of the 2 460 133 bundle opportunities that were seen were compliant. The monthly bundle trustworthiness and the monthly CLABSI rate were negatively correlated (-0.35 , $P < .001$). The partial correlation was -0.25 ($P = .004$) after correcting for the periodic trend. Only the hospital type indicated a significant positive interaction on negative binomial regression; compliance $\geq 95\%$ was significantly associated to reduced CLABSI rates at Hospital Within Hospital (but not freestanding children's hospitals). Bundles are strongly supported by data, although in real-world practice, noncompliance with maintenance procedures, hand hygiene, and sterile technique is common and frequently increases chronic infection rates (Glowicz, 2023). Numerous studies have looked into how

nurses can help prevent CLABSI by educating patients and encouraging them to follow prevention bundles. A quasi-experimental study carried out in Jordan showed that, despite no noticeable change in attitudes, ICU nurses' knowledge scores significantly improved following an educational intervention, rising from 37.34 ± 16.95 to 79.49 ± 21.73 ($p < 0.001$) (Alzoubi, et al., 2025). The current study intends to investigate the relationship between nurses' pre-existing knowledge and their adherence to CLABSI prevention bundles, without an intervention, even though similar studies evaluate the effects of organized training. Using indicators like Pearson correlation and Cronbach's Alpha.

These gaps are especially noticeable in Karachi's tertiary care facilities, where severe patient loads, a little resource, and high gadget utilization rates are typical. Quantitative studies examining the correlation between CLABSI infection rates and adherence to preventative bundling measures in these settings are scarce, despite the increased risk. By investigating the connection between nurses' awareness and implementation to CLABSI prevention strategies in Karachi's intensive care units, this study fills that information vacuum. By investigating this association, the study hopes to provide information that can back focused quality improvement programs in comparable high-demand, limited by resources healthcare settings.

Research Objective

To assess the relationship between ICU nurses' knowledge of CLABSI prevention bundles and their compliance with bundle practices.

Research Hypothesis:

H0:

There is no significant relationship between ICU nurses' knowledge of CLABSI prevention bundles and their compliance with bundle practices.

H1:

There is a significant relationship between ICU nurses' knowledge of CLABSI prevention bundles and their compliance with bundle practices.

Problem Statement

Patient safety in intensive care units (ICUs) is still seriously threatened by central line-associated bloodstream infections (CLABSI), especially in low- and middle-income nations like Pakistan (Latif, 2024). Despite the development of clinical guidelines and prevention bundles aim at reducing these infections, practical implementation frequently fails to meet expectations (Dukes, 2024). As the primary healthcare providers in charge of central line care, nurses are essential in making sure that these evidence-based procedures are followed. However, CLABSIs continue to occur in many intensive care unit (ICU) settings, particularly in settings with limited resources, due to nurses' lack of knowledge and unequal adherence to standard practices (Rosenthal, 2024). Higher nursing knowledge is linked to better compliance, according to international studies, but little research has examined this relationship in Pakistan (Ali, 2024; Safdar S. F., 2024; Waheed, 2025). Efforts to lower CLABSI rates might not be successful if knowledge is not understood to affect practice locally (Payne, 2025). By investigating the connection between ICU nurses' knowledge and their adherence to CLABSI prevention bundles, this study fills that knowledge gap. The results are intended to direct focused interventions, enhance infection control tactics, and assist quality improvement projects in critical care settings by determining whether knowledge has a direct influence on adherence.

Literature Review:**Theoretical Framework:**

Icek Ajzen presented the Theory of Planned Behavior (TPB). To better predict and explain behaviors—particularly those that are not entirely under volitional control—it incorporates the idea of perceived behavioral control into the Theory of Reasoned Action (TRA). According to the Theory of Planned

Behavior, people consciously choose how they behave. People are more likely to succeed if they put in more effort to carry out an activity (Ajzen, 2020). People are more likely to engage in an activity if they have a positive attitude (perception of the behavior's consequences), a subjective norm (perception of other people's approval), and a high degree of perceived control (perception of the behavior's difficulty). Reducing stigma may be accomplished by media interventions that aim to improve perceptions of control and alter attitudes and subjective norms to be more positive. A psychological paradigm that connects beliefs to conduct is called the theory of planned behavior (TPB). It implies that the most significant factor influencing a person's likelihood of engaging in an action is their intention to do so. Three main elements influence this intention: perceived behavioral control, subjective norms, and attitude toward the conduct. This is a person's assessment of the behavior, whether favorable or unfavorable. Their perceptions about the repercussions of the action have an impact on it. This is a representation of the perceived societal pressure to engage in the conduct or refrain from doing so. It is influenced by the person's motivation to follow the opinions of others and their perceptions about what other people believe they should do. This is the person's perception of how simple or complex the behavior is to carry out. It shows how confident they are in their capacity to carry out the behavior as well as how they view the opportunities and resources at their disposal. To put it simply, TPB argues that people are more likely to develop a strong intention to engage in a behavior if they have a good attitude toward it, think others approve of it, and feel capable of performing it. The main factor influencing whether they will carry out the conduct is their purpose.

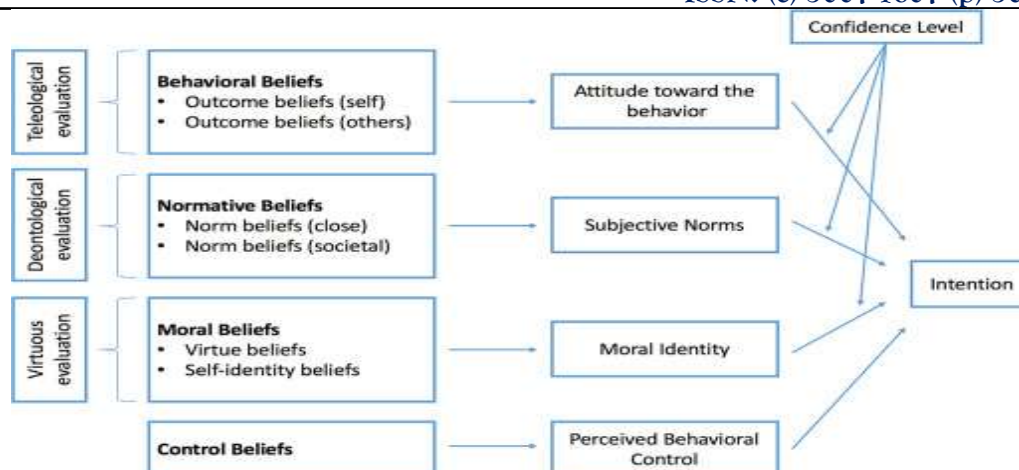


Fig 1: Theory of Planned Behavior by Icek Ajzen.

The Concept of Prevention Bundles and Evidence-Based Practice

A "bundle" in the context of healthcare is a collection of three to five evidence-based procedures that have been demonstrated to enhance patient outcomes when used consistently and in tandem (Smith, 2025). These bundles are organized approaches to improve care procedures and are made to deal with certain issues or circumstances. Scientific data supports the effectiveness of each intervention in the bundle in terms of enhancing patient care (Woodcock, 2024). To make them more manageable and simpler to apply, bundles usually include a small number of practices (three to five, on average). The effectiveness of a bundle depends on each intervention being carried out in unison and consistently, which guarantees that the patient benefits fully from the bundle (Hirao, 2025).

It has been demonstrated that the use of CLABSI (Central Line-Associated Bloodstream Infection) preventive bundles considerably lowers infection rates in hospital environments (Hamdan, 2025). Comprehensive bundles, which include measures including hand hygiene, maximal barrier precautions, chlorhexidine skin antisepsis, and prompt catheter removal, have been shown in studies to significantly reduce the incidence of CLABSI (Kumar, 2025). Significant drops in CLABSI rates have been documented in studies after preventative bundles were put into place (Sivakumar, 2024). Over a five-year period, CLABSI rates decreased by 46%, (Krishnan, 2024). Implementing insertion or maintenance

bundles, or both, could reduce CLABSI rates in intensive care units by 60%, according to a meta-analysis of 79 studies (Hamdan, 2025). Due to fewer hospital stays and treatment expenses, preventing CLABSIs through bundle implementation can result in significant cost savings. According to certain research, with continued observation and modification, the advantages of bundle implementation can be maintained throughout time. It is essential to wash your hands thoroughly both before and after handling the catheter site. The risk of infection is reduced when full barrier measures are used during catheter placement, such as a full-body drape, sterile gloves, a mask, a cap, and a gown (Sivakumar, 2024). Bacterial colonization can be decreased by applying an antiseptic solution containing chlorhexidine to the skin surrounding the insertion site (Duque, 2024). To prevent infection, catheters must be removed as soon as they are no longer required (Fletke, 2024).

Nurses' Knowledge in Infection Prevention

Since infection prevention techniques, particularly CLABSI bundles, have a direct impact on patient safety, lower healthcare costs, and enhance overall patient outcomes, it is imperative that nurses have a high degree of awareness about them (Lucchini, 2024). By correctly adhering to infection control procedures, nurses can help prevent CLABSIs (Central Line-Associated Bloodstream Infections), which are a major issue. Since they provide the most direct patient contact and are

on the front lines of patient care, nurses are essential in preventing HAIs like CLABSI (Alnadawy, 2024). Morbidity, mortality, and medical expenses are all markedly raised by CLABSI (Sivakumar, 2024; Chang, 2025). Nurses can reduce the risk of these diseases by appropriately implementing infection control measures. Prior studies have consistently identified a number of important elements that affect nurses' knowledge. These consist of years of experience, years of education, hands-on training, and access to pertinent information sources (Yuan, 2025). Increased knowledge and proficiency in nursing practice are typically linked to longer experience, more thorough practical training, and higher educational levels. To stay informed and implement evidence-based practices, nurses also need easy access to current research, guidelines, and other resources. Higher degree-holding nurses, such as those with a bachelor's or master's degree, frequently exhibit a deeper and more comprehensive comprehension of nursing concepts, research techniques, and evidence-based practice (Couto, 2025). Clinical rotations, simulations, and continuing education programs are examples of practical training that gives nurses real-world experience while reinforcing theoretical knowledge.

Research Methodology

Research design:

The research design is quantitative correlational research. It was performed in the intensive care units (ICUs) of tertiary care hospitals in Karachi. Correlational research seeks to ascertain whether a link is there between variables and to characterize its strength and direction whether it is positive, negative, or uncorrelated (Khatib, 2025). In this study there are two variables, ICU nurses' knowledge of CLABSI prevention and compliance rate of CLABSI in ICU which are independent and dependent variables respectively. The relationship between these two variables is analysed and expressed statistically by correlation. It is used to explain basic relationship without intervention.

Sampling Technique: Sampling procedure consisted of two steps. Firstly, units were selected where CLABSI cases have been

reported and where central venous catheters (CVCs) are commonly used. Secondly, The study included 55 nurses and medical professionals who were educated in CLABSI prevention procedures and assisted in central line management, the population of the research was selected via simple random sampling technique. Choosing a sample from a larger group using random sampling gives every member of the population an equal and independent probability of being selected (Giri, 2024). By doing this, the sample is guaranteed to be representative of the population, enabling researchers to draw conclusions about the population as a whole. They were asked to fill out an online survey after being recruited through internal interaction methods. Based on previous cross-sectional KAP (Knowledge-Attitude-Practice) surveys carried out within intensive care units 55 respondents are deemed sufficient for regression modelling, correlation analysis, and descriptive statistics.

Data Collection Instrument: Data was collected via self-administered google survey form which consisted of 3 sections. one was about demographic information. Second section consisted of 10 questions related to Self-reported adherence to the CLABSI prevention bundle components (hand hygiene, maximal sticks, chlorhexidine antiseptis, sterile maintenance, quick removal, etc.) is evaluated using 20 Likert-scale items. Last section assessed the compliance rate of CLABSI via Likert scale. This structure is based on validated tools used in CLABSI preventative surveys for intensive care unit nurses (Hamdan, et al., 2025; Singh, et al., 2024). The instrument was piloted to check the reliability of the questionnaire. The reliability of the questionnaire was tested using Cronbach alpha.

Ethical Consideration:

The participants' agreement was obtained prior to data collection and through google form option as well. It was made explicit that the data would only be used for research purposes and that they might withdraw from the study at any time. Throughout the whole study, ethical criteria were strictly adhered, to ensure the safety and well-being of each participant. Nurses' informed consent was obtained, and

participation was entirely voluntary. All of the participants were fully informed about the study's objectives. Confidentiality and anonymity were maintained, and all data was handled with the highest privacy by using codes instead of personal identification. In conclusion, all BERA framework protocols were followed. All responders' anonymity and confidentiality were carefully protected. The information gathered was safely kept and utilized only for scholarly and research purposes only.

Data Analysis: The collected data was analysed using IBM SPSS Statistics version 21. Firstly

The internal consistency of the questionnaire, measured by Cronbach's alpha which was found to be 0.735, indicating acceptable reliability. To analyse the participants' compliance scores and awareness of CLABSI preventative measures, descriptive statistics such as the mean, standard deviation, minimum, and maximum values were assessed through descriptive statistics. To determine the relationship between nurses' knowledge and adherence to CLABSI prevention bundle protocols, inferential analysis was performed using Pearson correlation. A threshold of $p < 0.05$ was established for statistical significance.

Results:

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Nurses CLABSI Knowledge	55	24.00	42.00	2035.00	35.0862	4.44966
Nurses CLABSI Compliance	55	30.00	55.00	2548.00	45.5000	6.09023
Valid N (listwise)	55					

Table 1 shows the descriptive statistics for nurses' knowledge of central line associated blood stream infections (CLABSI) and nurses' compliance to the gained knowledge. The study involves 55 nurses. The total score of nurses' knowledge is 2035.00 with scores scattering between 24.00 to 42.00. The average knowledge score of nurses according to the table is 35.09 with the SD = 4.45. This gives glimpse into nurses' knowledge of CLABSI, which reveals that they have right munt of

knowledge. The other variable shown in table is nurses compliance rate, the sum of compliance is 2548.00 which ranged between 30.00 to 55.00. The average CLBSI compliance is found 45.50 with SD = 6.09. It is found from the table that nrses compliance with the average 45.500 is higher and their CLABSI knowledge with mean = 35.0862 which is modest too. The standard deviation for both the cases indicates that their compliance is more dispersed than their knowledge.

Table 2: Correlations

		Nurses' Knowledge	Nurses' Compliance
Nurses' Knowledge	Pearson Correlation	1	.827**
	Sig. (2-tailed)		.000
	N	55	55
Nurses' Compliance	Pearson Correlation	.827**	1
	Sig. (2-tailed)	.000	
	N	55	55

** . Correlation is significant at the 0.01 level (2-tailed).

To understand how nurses' knowledge influences their real-world practices, a Pearson correlation analysis was conducted between

the total knowledge scores and total compliance scores of ICU nurses. The total knowledge score was calculated based on

responses to items measuring awareness and understanding of CLABSI prevention guidelines, while the total compliance score reflected how consistently nurses reported following each step of the prevention bundle during patient care. Table 2 shows the correlation between the knowledge and compliance rate using Pearson correlation test. The Pearson correlation (r) = 0.827 suggests a strong, significant and positive and linear association between both the variables. The $r=0.827$ suggests that nurses are more likely to follow CLABSI prevention strategies when they are more knowledgeable and well informed about the protocols. A 2-tailed significance value (p) is 0.00 supports the significance of correlational statistics ($p<0.01$). The null hypothesis is rejected, according to which there is no connection between knowledge of nurses with their compliance rate. The findings give clear statistical evidence that if nurses are knowledgeable about the protocols and standards of CLABSI prevention, they are more likely to comply and adhere to the guidelines of CLABSI. This study just suggests the relationship between knowledge and compliance which means if knowledge increases the compliance increases too and when knowledge rate is less the compliance drops too.

Beyond the numbers, this correlation speaks to the deeper connection between education and action in the nursing profession. When nurses are equipped with evidence-based knowledge, they are better positioned to act confidently and conscientiously in the care of vulnerable ICU patients. The data supports what many clinicians have long understood: that knowledge empowers practice, and practice rooted in knowledge protects lives. These findings reinforce the importance of continuous learning and structured training programs in critical care settings. In environments where patient safety is constantly challenged by resource limitations, investing in nurses' education becomes not only a clinical priority but a moral one as it directly impacts outcomes and saves lives.

Discussion

The study shows the closer relationship between nursing education and practice. These results aligned with studies (El-Sayed, 2025). Nurses' confidence in caring for vulnerable intensive care unit patients is much increased when they possess evidence-based knowledge (Lima, 2024; Elsayed, 2025). Better knowledge and use of evidence-based procedures (EBP), which are essential for providing high-quality, patient-centered care, are the source of this confidence (Atalla, 2025). The incidence rate of Central Line-Associated Bloodstream Infection (CLABSI) in hospital settings is significantly correlated with nurses' understanding of CLABSI prevention (Alqalah, 2024). Nurses who possess more knowledge are more likely to adhere to infection control procedures, which lowers the incidence of CLABSI (Almalki, 2023). Research indicates that infection rates were considerably reduced by nurse-led teaching modules on CLABSI prevention (Iqbal, 2025; Rachel Scheitlin, 2024). For example, following the implementation of focused training, a paediatric institution observed a 40% decrease in the prevalence of CLABSI (Morgenstern, 2025). Studies found that greater CLABSI rates were associated with knowledge gaps on aseptic procedures and catheter maintenance (Alqaissi, 2025; Snyder, 2021).

The results show that CLABSI is mitigated with the use of checklist to ensure adherence to aseptic technique during catheter insertion. Checklists help ensure that aseptic procedure is followed during catheter placement, which is essential for preventing CLABSI (central line-associated bloodstream infections) (Chi X. W., 2024). By guaranteeing that healthcare professionals constantly adhere to best practices when placing catheters, checklists improve adherence to established infection control protocols (WHO, 2024). It has been demonstrated that this methodical technique considerably lowers infection rates (Hamdan, 2025). By standardizing the insertion procedure, checklists guarantee that all essential aseptic procedures are performed, including hand washing and chlorhexidine skin disinfection (Kweon, 2025; Beville, 2025). Research shows that implementing

checklists can reduce the incidence of CLABSI. For example, one study found that using a checklist reduced the number of infections per 1000 catheter days from 5.9 to 3.8 (Bottet, 2025). Consistently keeping an eye on whether checklist procedures are being followed enables prompt feedback, which can raise adherence rates. Checklist compliance was associated with a 41% decrease in CLABSI in a neonatal unit (Rajandra, 2025). The checklist contribution to improving aseptic technique adherence and lowering CLABSI rates is supported by the findings. The study also found that Chlorhexidine is the preferred antiseptic for skin preparation before the insertion to reduce CLABSI rate (Helmi, 2023). The study revealed that hospitals that have less cases of CLABSI ensure prompt availability of alcohol based hand rubs at every patient bedside in the ICUs (Mazzeffi, 2025). The standardized protocol for catheter insertion and maintenance in the unit leads to prevention in CLABSI (Chi, 2024).

The study shows that regular bundle compliance audits are negatively correlated to CLABSI rate. Alongside education and knowledge regular audits confirm the practice and mitigates the chances of negligence. By verifying adherence to best practices and pinpointing areas for improvement, compliance audits of CLABSI bundles are essential in lowering infections linked to healthcare (Hamdan, 2025). Preventing central line-associated bloodstream infections (CLABSIs) requires maintaining high standards of care, which these audits aid in doing. Numerous studies that demonstrate these audits' influence on infection rates and general patient safety attest to their efficacy (Hut-Mossel, 2021). It has been demonstrated that routine audits and compliance checks greatly increase adherence to central line maintenance procedures, which lowers CLABSI rates (Tripathi, 2023). Bundle compliance and CLABSI rates were found to be negatively correlated in another study, suggesting that lower infection rates are linked to higher compliance (Goldman, 2021; Chemparathy, 2021). The largest decreases in CLABSI rates were seen in hospitals with compliance rates

of 95% or above (Tripathi et al., 2023). Real-time instruction and feedback are frequently included in compliance audits, and they are essential for enhancing protocol adherence. Multidisciplinary strategies have proven successful in improving adherence to CLABSI preventive bundles, including frequent audits and staff training (Goldman J. R., 2021). These tactics lower infection rates by ensuring that all medical professionals understand and follow the required procedures. This emphasizes how crucial it is to take a holistic approach that include audits and ongoing education.

Nurses are better able to act with confidence and diligence when caring for vulnerable intensive care unit patients when they possess evidence-based knowledge. The data supports what many clinicians have long understood: that knowledge empowers practice, and practice rooted in knowledge protects lives. These findings reinforce the importance of continuous learning and structured training programs in critical care settings. In environments where patient safety is constantly challenged by resource limitations, investing in nurses' education becomes not only a clinical priority but a moral one as it directly impacts outcomes and saves lives.

Conclusion:

The study showed that Nurses knowledge of CLABSI prevention bundle is positively related to Compliance rate of central line - associated infections. Which means when knowledge of the nurses increases the compliance rate increases as well. The nurses who The findings and the evidence currently available support the concept that regular, specific instruction could enhance knowledge and compliance. It is also concluded that regular ongoing audits along with knowledge is crucial to keep check with the adherence rate. In addition, the regular audits give glimpses into other shortfalls like lack of resources. Maintaining infection control practices depends heavily on the nurse-to-patient ratio. ICU nurses' knowledge and adherence to CLABSI prevention measures proved to be strongly and significantly correlated in this study. The findings indicate that nurses are more likely to adhere to

evidence-based infection control procedures when they are knowledgeable and well-trained. Some variation continued even with generally high levels of knowledge and compliance, suggesting the need for ongoing training and institutional support. Maintaining high standards of care and lowering CLABSI rates in high-risk hospital units, such as intensive care units, can be achieved by funding frequent training, resource availability, and continuous audits. These results can direct future quality improvement initiatives and are especially important in environments with limited resources.

Recommendation:

The following recommendations are made in light of the findings.

1. Frequent training sessions are suggested for nurses and healthcare workforce to strengthen understanding and proficiency with CLABSI bundle protocols.
2. Regular audits and feedback mechanisms should be necessitated to monitor compliance and identify areas of improvement.
3. Administrative assistance is required to guarantee that supplies such as sterile barrier kits, chlorhexidine, and staff training materials are available.

Conflict of Interest

Regarding the publication of this study, the authors affirm that they have no conflicts of interest. The design, performance, and reporting of this study were not impacted by any financial, personal, or professional relationships.

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