INTERNATIONAL JOURNAL OF SOCIAL SCIENCES BULLETIN
ISSN: (E) 3007-1917 (P) 3007-1909
Volume 3, Issue 9, 2025

# EFFECTIVENESS OF EDUCATIONAL INTERVENTION ON NURSES' KNOWLEDGE REGARDING CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTION PREVENTION

**Mishal William[1], Hina Arshad[*2], Mehak Ghafoor[3], Humaira Hameed[4], Umm-e-Amna[5], Saba Bashir[6], Sabahat Ghafoor[7], Humaira Shaukat[8], Azra Riaz[9]**

*[1,3,4,5,6,7,8,9]Post RN Student, Saida Waheed College of Nursing.*
*[*2]Deputy Director Academic, Saida Waheed College of Nursing.*

[1]mishal.william789@gmail.com, [*2]hinaadeel31@gmail.com, [3]ghafoor21@gmail.com, [4]habbangurmani55967@gmail.com, [5]ummamna59@gmail.com, [6]bashirsaba023@gmail.com, [7]sabahatghafoor52@gmail.com, [8]humairashaukat11@gmail.com, [9]azrariaz987@gmail.com

**Corresponding Author: ***
**Hina Arshad**
DOI:https://doi.org/10.5281/zenodo.17190045

| Received | Revised | Accepted | Published |
|---|---|---|---|
| 01 July 2025 | 15 July, 2025 | 11 September 2025 | 24 September 2025 |

## ABSTRACT

***Background:*** *Central Line-Associated Bloodstream Infections (CLABSIs) remain a significant healthcare challenge, contributing to increased morbidity, mortality, and healthcare costs. Adherence to evidence-based guidelines plays a crucial role in prevention, and educational interventions for nurses can enhance knowledge and compliance.*

***Objective:*** *To evaluate the effectiveness of an educational intervention on nurses' knowledge regarding CLABSI prevention, and to assess the association between knowledge levels and selected demographic variables of ICU nurses at Fatima Memorial Hospital, Lahore.*

***Methods:*** *A quasi-experimental pre/post design was conducted over four months with 40 ICU nurses selected through convenient sampling. Eligible participants were aged 25–40 years, with 1–10 years of experience, working in Paediatric, Medical & Surgical ICU, NICU, CCU, HDU, and Dialysis units. Data were collected using a structured questionnaire, and results were analysed using descriptive and inferential statistics.*

***Results:*** *Most participants (70%) were aged 26–30 years, and 87.5% were female. Qualifications included Post RN B.Sc. Nursing (40%), Generic B.Sc. Nursing (32.5%), and General Nursing Diploma (27.5%). Clinical experience ranged from 3–6 years (87.5%) to 7–10 years (12.5%). Prior CLABSI training was reported by 42.5%. Pre-test results showed 80% had moderate knowledge and 10% adequate knowledge. Post-intervention, 80% achieved adequate knowledge, with no participants in the inadequate category. Knowledge scores were significantly associated with demographic variables.*

***Conclusion:*** *The educational intervention proved effective in enhancing nurses' knowledge of CLABSI prevention. Regular training programs and reinforcement of evidence-based guidelines are recommended to sustain knowledge and improve clinical practices, ultimately reducing infection rates and improving patient outcomes.*

***Keywords:*** *Effectiveness, Nurses, Knowledge, Central Line Associated Infection.*

## INTRODUCTION

Central line-associated bloodstream infections (CLABSI) are serious healthcare-associated infections that arise from central venous catheter (CVC) insertion and maintenance (Patel et al., 2019). They pose significant risks to patient safety due to high morbidity, mortality, and economic

burden. CLABSI occurs when pathogens enter the bloodstream through a central line, often because of inadequate aseptic practices (Mostafa et al., 2022). According to Al-Yateem in 2021, evidence-based CLABSI guidelines provide benchmarks for infection prevention, guide reflective practice, and support operational protocols (Al-Yateem, 2021).

The financial and clinical impact of CLABSI is substantial. Ball and Singh in 2020 reported that each case can increase healthcare costs by $33,000 and extend hospital stays by three weeks (Sartelli et al., 2020). Risk of infection also varies by site; femoral catheter placement carries higher infection rates compared to jugular access (Celegen & Celegen, 2023). Preventive measures, including hand hygiene with alcohol-based rubs or antiseptic solutions, sterile gloves, and aseptic insertion techniques, are essential (Kramer et al., 2022). Nurses are central to these practices, ensuring sterile handling, proper dressing, and documentation, making their role critical in CLABSI prevention (Star et al., 2024).

Global studies show variation in CLABSI prevalence. For instance, Kuwait reported 14.9 cases per 1,000 catheter days (Al-Shukri, 2021). In Pakistan, where central line use is common, high CLABSI rates persist due to limited nurse training (Hussain et al., 2021). Conversely, countries emphasizing specialized training have achieved better outcomes (Kim & Park, 2020). This highlights the importance of professional education and adherence to international standards.

Nurse staffing also influences infection rates. Adequate nurse-to-patient ratios have been linked with reduced CLABSI incidence and improved survival (AlHarbi et al.). Centers requiring mandatory training before CVC management report safer practices (Saade et al., 2024). However, variability in adherence across hospital units suggests a need for consistent reinforcement of infection control measures (Brooks et al., 2021).

The Centers for Disease Control and Prevention (CDC) has outlined evidence-based guidelines for both CVC insertion and maintenance (Piner, 2023). Insertion standards include hand hygiene, maximal sterile barriers, chlorhexidine skin antisepsis, optimal site selection, and avoiding unnecessary guidewire exchanges (DeVries & Hallam, 2024). Maintenance standards focus on sterile dressings, routine replacement of tubing and transducers, and aseptic handling during access or dressing changes (JOSEPH et al., 2022). Nurses, being primarily responsible for line maintenance, play a pivotal role in ensuring compliance with these measures (Vaismoradi et al., 2020).

Despite established guidelines, studies show gaps in nurses' knowledge and compliance. Research in Egypt revealed low awareness and adherence to evidence-based practices (Al-Tamimi et al., 2023). This underscores the need for periodic reassessment and continued training (Ayoola et al., 2024). According to recent report stressed that regular evaluation of staff knowledge is essential to sustain preventive practices (Idrus, 2025). Evidence further suggests that nurses who receive ongoing training or pursue advanced education demonstrate stronger adherence to aseptic practices, ultimately lowering nosocomial infection rates (Hawker et al., 2022). The purpose of this study was to evaluate the effectiveness of an educational intervention in improving nurses' knowledge regarding the prevention of central line-associated bloodstream infections (CLABSI) and to examine the association between knowledge levels and selected demographic variables among ICU nurses at Fatima Memorial Hospital, Lahore.

**Hypotheses**

- **Null Hypothesis ($H_0$):** There is no significant difference in nurses' knowledge regarding CLABSI prevention before and after the educational intervention.

- **Alternative Hypothesis ($H_1$):** There is a significant difference in nurses' knowledge regarding CLABSI prevention after the educational intervention.

**Materials and Methods:** A quasi-experimental pre- and post-test study was carried out at Fatima Memorial Hospital, Lahore, over a period of four months following approval from the Institutional Review Board (IRB). A total of 40 nurses, aged 25–40 years with 1–10 years of clinical experience, were selected through convenient sampling from ICUs, NICU, CCU, HDU, Paediatrics, and Dialysis units. Student nurses, unwilling staff, and those working in general wards were excluded. Data were collected using a

validated and reliable questionnaire (Sachan et al., 2022; r = 0.81), which included demographic information and 20 multiple-choice questions assessing knowledge of CLABSI. A pre-test was administered, followed by an educational intervention consisting of a structured presentation covering CLABSI definition, risk factors, causes, and CDC prevention standards, and then a post-test survey. Ethical considerations, including informed consent, voluntary participation, and the right to withdraw, were strictly observed. The paired t-test was applied to evaluate the effectiveness of the educational intervention on nurses' knowledge of CLABSI prevention, with $p < 0.05$ considered statistically significant. Additionally, one-way ANOVA was used to determine the association between demographic variables and knowledge scores.

**Results**

**Table 1: Distribution of Participants by Sociodemographic Variables**

| | | n | % |
|---|---|---|---|
| Age (years) | 21-25 | 6 | 15 |
| | 26-30 | 28 | 70 |
| | 31-35 | 6 | 15 |
| | 36 and above | 0 | 0 |
| | | n | % |
| Gender | Male | 5 | 12 |
| | Female | 35 | 88 |
| Analyzed by frequency 'n' and percentage '%' | | | |

Table 1 describes the sociodemographic characteristics of the study participants. The majority of nurses (70%) were between 26–30 years of age, followed by 15% each in the age groups of 21–25 and 31–35 years, while none were above 36 years. Regarding gender, most participants were female (88%), whereas only 12% were male.

**Table 2: Distribution of Participants by Educational Status and Years of Experience**

| | | n | % |
|---|---|---|---|
| Educational status | General Nursing Diploma | 11 | 27 |
| | B.Sc. Nursing | 13 | 33 |
| | Post-basic B.Sc. Nursing | 16 | 40 |
| | | n | % |
| Years of Experience | <2 | 0 | 0 |
| | 3-6 | 35 | 87 |
| | 7-10 | 5 | 13 |
| | Above 10 | 0 | 0 |
| Analyzed by frequency 'n' and Percentage '%' | | | |

Table 2 describes the educational status and years of experience of the study participants. Most nurses (40%) held a post-basic B.Sc. Nursing degree, followed by 33% with a B.Sc. Nursing degree and 27% with a General Nursing Diploma. In terms of professional experience, the majority (87%) had 3–6 years of experience, while 13% had 7–10 years, and none had less than 2 years or more than 10 years of experience.

**Table no 3: Knowledge level of nurses before and after educational intervention**

| Level of knowledge | Pre-test | | Post-test | |
|---|---|---|---|---|
| | n | % | n | % |
| Inadequate | 4 | 10 | 0 | 0 |
| Moderate | 32 | 80 | 8 | 20 |

| | | | | |
|---|---|---|---|---|
| Adequate | 4 | 10 | 32 | 80 |
| Total | 40 | 100 | 40 | 100 |
| Analyzed by frequency 'n' and percentage '%' | | | | |

Table no 3 Level of knowledge categorized as Inadequate, moderate and adequate knowledge. 10% had pretest adequate and inadequate knowledge level, 80% moderate. While in posttest 20% showed moderate and 80% showed adequate knowledge and no one showed inadequate knowledge level after educational interventional session.

**Table no 4: Knowledge level of the study participants**

| Knowledge Level | Pre-test (Mean ± SD) | Post-test (Mean ± SD) | P-value |
|---|---|---|---|
| Overall, Knowledge Score | 1.98 ± 0.46 | 2.70 ± 0.46 | 0.001 |
| *Analyzed by paired t test with p less than 0.05* | | | |

Table no 4 presents the comparison of participants' knowledge scores regarding CLABSI prevention before and after the educational intervention. The overall mean knowledge score improved significantly from 1.98 ± 0.46 in the pre-test to 2.70 ± 0.46 in the post-test, with a p-value of 0.001, indicating a statistically significant increase in knowledge following the intervention.

**Table 5: Association of Post-test Knowledge Scores with Educational Status and Years of Experience among Nurses**

| Demographic Variable | Category | Post-test Mean ± SD | P-value |
|---|---|---|---|
| **Educational Status** | General Nursing Diploma | 2.50 ± 0.42 | 0.064 |
| | B.Sc. Nursing | 2.68 ± 0.44 | 0.041 |
| | Post RN B.Sc. Nursing | 2.85 ± 0.40 | 0.001 |
| **Years of Experience** | 3–6 years | 2.68 ± 0.45 | 0.062 |
| | 7–10 years | 2.75 ± 0.48 | 0.024 |
| *Analyzed by one-way Anova with p less than 0.05* | | | |

Table no 5 presents the association between nurses' post-test knowledge scores on CLABSI prevention and selected demographic variables. Analysis using one-way ANOVA showed that **educational status** had a significant effect on knowledge improvement. Post RN B.Sc. Nursing graduates achieved the highest post-test mean score (2.85 ± 0.40, $p = 0.001$), followed by B.Sc. Nursing graduates (2.68 ± 0.44, $p = 0.041$). Although General Nursing Diploma holders also improved (2.50 ± 0.42), their results did not reach statistical significance ($p = 0.064$). Similarly, **years of experience** showed a significant association with knowledge scores. Nurses with 7–10 years of experience scored slightly higher (2.75 ± 0.48, $p = 0.024$) compared to those with 3–6 years (2.68 ± 0.45, $p = 0.062$).

**Discussion:**

The present study evaluated the effectiveness of an educational intervention on nurses' knowledge regarding CLABSI prevention. The results demonstrated a significant improvement in knowledge scores after the intervention, with 80% of participants achieving adequate knowledge, compared to only 10% before the training. These findings are consistent with several previous studies. Ahmed and colleagues in 2019 also reported that more than half of nurses initially had only fair knowledge levels, but post-test scores improved markedly following an educational program (Ahmed, 2022). Similarly, Dsilva found that nurses' knowledge increased one week after receiving a self-instructional module on central venous catheter care (Dsilva et al., 2022), while Abdo and colleagues observed significant gains two weeks after an educational intervention (Abdo et al., 2020). These

similarities suggest that structured training consistently enhances knowledge across different clinical settings.

The demographic analysis of this study showed that education level and years of experience were significantly associated with post-test knowledge scores. This contrasts with findings from Sachan and colleagues in Kanpur, where no such association was found (Sachan et al., 2022). The difference may be explained by variations in sample size, educational background, and institutional emphasis on infection control practices.

In terms of baseline knowledge, the pre-test results of this study (80% moderate knowledge, 10% inadequate, 10% adequate) are in partial agreement with Sachan and colleagues, who also observed knowledge deficits among nurses (Sachan et al., 2022). However, the results differ sharply from Ahmad and colleagues study in Srinagar, where 70% of nurses had inadequate knowledge regarding CLABSI, with mean scores significantly lower than those observed in the present study (Ahmed et al., 2021). Such discrepancies may reflect contextual differences, such as training opportunities, availability of resources, and exposure to infection control protocols.

In contrast to the positive outcomes reported here and in other studies, Chi and colleagues in China identified persistent knowledge and practice gaps among 835 ICU nurses, where only 43% consistently used maximum barrier precautions, and 14% had never used chlorhexidine for antisepsis (Chi et al., 2020). This divergence highlights that while educational interventions may improve knowledge, consistent adherence to evidence-based practices requires not only training but also continuous monitoring, institutional support, and reinforcement through infection control policies.

**Conclusion:** The present study demonstrates that while nurses initially showed moderate levels of knowledge, the implementation of an educational program led to a statistically significant improvement in knowledge scores. This reinforces the importance of structured training sessions, continuous education, and adherence to evidence-based guidelines in reducing the risk of CLABSI and promoting patient safety.

**Practical Implications**: The findings of this study highlight several important implications for nursing practice, education, and hospital policy.

- **Clinical Practice:** Regular educational interventions should be incorporated into routine nursing practice to ensure consistent adherence to CLABSI prevention protocols.
- **Nursing Education:** Continuous professional development programs, workshops, and refresher courses should be institutionalized to update nurses on evolving evidence-based guidelines.
- **Hospital Administration:** Hospital policies should emphasize mandatory training sessions on infection prevention and establish monitoring mechanisms, such as audits and feedback systems, to reinforce compliance.
- **Patient Safety:** By improving nurses' knowledge and adherence to evidence-based guidelines, the likelihood of CLABSI can be significantly reduced.

## REFERENCES

Abdo, N. M., Ramadan, M. A., Tosson, M. M., & Al-Fadhli, M. A. (2020). Effectiveness of an educational program on knowledge and practices regarding care of central venous catheters among dialysis nurses. *Egyptian Journal of Community Medicine*, *38*(1), 1-11.

Ahmed, S., Esmat, H., Mohammed, M., & Abdalla, S. (2021). Impact of Mini Structured Education Program on ICU Nurses Knowledge and Practice Regarding Prevention of Central Venous Line Associated Blood Stream Infection in Alshaab Teaching Hospital-Khartoum City–2020. *EAS Journal of Nursing and Midwifery*, *3*(1), 59-56.

Ahmed, Z. (2022). *Evaluating a multi-component group intervention for improving psychological well-being of trainee civil servants in Pakistan: A randomised controlled study*. The University of Liverpool (United Kingdom).

Al-Shukri, R. N. K. (2021). *Prevalence, Predictors and Outcomes of ICU-Acquired Central Line-Associated Bloodstream Infections in Oman*. Sultan Qaboos University (Oman).

Al-Tamimi, M., Refaat, F., & Issa, W. B. (2023). Barriers to compliance with evidence-based guidelines for ventilator-associated pneumonia among critical care nurses: A scoping review. *F1000Research*, *11*, 1551.

Al-Yateem, I. S. A. (2021). *Knowledge, Behavior and Attitude of Nurses Regarding Prevention of Central Line Associated Blood Stream Infections* Royal College of Surgeons in Ireland].

AlHarbi, A. J., Almenieir, N. N., abdaullh Alabdaziz, H., Alotaibi, A. S., & Alotaibi, F. M. E. " Exploring the Impact of Nurse Staffing Levels on Hospital-Acquired Infection Prevention.

Ayoola, V. B., Audu, B. A., Boms, J. C., Ifoga, S. M., Mbanugo, O., & Ugochukwu, U. N. (2024). Integrating Industrial Hygiene in Hospice and Home Based Palliative Care to Enhance Quality of Life for Respiratory and Immunocompromised Patients. *IRE Journals*, *8*(5).

Brooks, S. K., Greenberg, N., Wessely, S., & Rubin, G. J. (2021). Factors affecting healthcare workers' compliance with social and behavioural infection control measures during emerging infectious disease outbreaks: rapid evidence review. *BMJ open*, *11*(8), e049857.

Celegen, M., & Celegen, K. (2023). Determination of central venous catheter complications: Internal jugular vein versus femoral vein catheterization.

Chi, X., Guo, J., Niu, X., He, R., Wu, L., & Xu, H. (2020). Prevention of central line-associated bloodstream infections: a survey of ICU nurses' knowledge and practice in China. *Antimicrobial Resistance & Infection Control*, *9*(1), 186.

DeVries, M., & Hallam, C. (2024). Insertion Related Infection Prevention with Vascular Access Devices. In *Vessel Health and Preservation: The Right Approach for Vascular Access* (pp. 295-309). Springer.

Dsilva, F., Mathew, S., & Joseph, G. (2022). Effectiveness of a self-instructional module on knowledge and observed practices of nurses with regard to prevention of central line–associated blood stream infection: A before–after intervention study. *Journal of Health Management*, *24*(2), 233-239.

Hawker, C., Gould, D., Courtenay, M., & Edwards, D. (2022). Undergraduate nursing students' education and training in aseptic technique: A mixed methods systematic review. *Journal of Advanced Nursing*, *78*(1), 63-77.

Hussain, A. S., Ahmed, A. M., Arbab, S., Ariff, S., Ali, R., Demas, S., Zeb, J., Rizvi, A., Saleem, A., & Farooqi, J. (2021). CLABSI reduction using evidence based interventions and nurse empowerment: a quality improvement initiative from a tertiary care NICU in Pakistan. *Archives of Disease in Childhood*, *106*(4), 394-400.

Idrus, S. (2025). Performance Management Reimagined: Moving Beyond Annual Reviews to Continuous Feedback. *The Journal of Academic Science*, *2*(1), 222-231.

JOSEPH, M. P. S., GAUTAM, M. S., VERMA, M. T., LAL, M. M. N., & MADHALE, D. M. D. (2022). *INFECTION CONTROL & SAFETY*. Xoffencerpublication.

Kim, J., & Park, C. Y. (2020). Education, skill training, and lifelong learning in the era of technological revolution: A review. *Asian-Pacific Economic Literature*, *34*(2), 3-19.

Kramer, A., Arvand, M., Christiansen, B., Dancer, S., Eggers, M., Exner, M., Müller, D., Mutters, N. T., Schwebke, I., & Pittet, D. (2022). Ethanol is indispensable for virucidal hand antisepsis: memorandum from the alcohol-based hand rub (ABHR) Task Force, WHO Collaborating Centre on Patient Safety, and the Commission for Hospital Hygiene and Infection Prevention (KRINKO), Robert Koch Institute, Berlin, Germany. *Antimicrobial Resistance & Infection Control*, *11*(1), 93.

Mostafa, F. A., Alnafee, K., Al Shanqiti, K., Siddiq, N., Alshuhri, S., & Badawi, D. (2022). Reducing central-line–associated bloodstream infections (CLABSI): an improvement project in a specialized tertiary hospital. *Global journal on quality and safety in healthcare*, *5*(4), 84-92.

Patel, P. K., Olmsted, R. N., Hung, L., Popovich, K. J., Meddings, J., Jones, K., Calfee, D. P., Fowler, K. E., Saint, S., & Chopra, V. (2019). A tiered approach for preventing central line–associated bloodstream infection. *Annals of internal medicine*, *171*(7_Supplement), S16-S22.

Piner, D. (2023). *Implementing an Evidence Based Central Venous Catheter (CVC) Maintenance Bundle* Southeastern Louisiana University].

Saade, E. A., Lytle, F. T., & Pronovost, P. J. (2024). Enhancing Quality and Safety in Critical Care—Challenges and Strategies for Central Venous Catheters. *JAMA Internal Medicine*, *184*(5), 482-483.

Sachan, R., Pandey, S., Kumar, R., Singh, D., Sharma, S., Kumar, K., Singh, A., Pal, S., Verma, A. K., & Sachan, H. (2022). Effect of phosphorous, chloropyriphos and rhizobium inoculation on production and economics of chickpea (Cicer aretinum L.). *International Journal of Plant & Soil Science*, *34*(22), 1390-1398.

Sartelli, M., Pagani, L., Iannazzo, S., Moro, M. L., Viale, P., Pan, A., Ansaloni, L., Coccolini, F., D'Errico, M. M., & Agreiter, I. (2020). A proposal for a comprehensive approach to infections across the surgical pathway. *World Journal of Emergency Surgery*, *15*(1), 13.

Star, K. E., Lindsey, K., Reese, S. M., Paulino, L., Hernandez, L. L., Tynes, I., Eiseman, K., & Tynes, J. (2024). Reducing central line-associated bloodstream infection with a dedicated CLABSI prevention registered nurse role. *American journal of infection control*, *52*(6), 659-663.

Vaismoradi, M., Tella, S., A. Logan, P., Khakurel, J., & Vizcaya-Moreno, F. (2020). Nurses' adherence to patient safety principles: a systematic review. *International journal of environmental research and public health*, *17*(6), 2028.

IEER
Institute for Excellence in Education & Research