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

Shailendra Singh[1], Abhishek Sharma[2], Manish Dhawan[3], Seerat P Sharma[4]

ABSTRACT

Aim: The objective of this study was to assess the extent of knowledge and application of central line bundles in the intensive care unit (ICU) of a tertiary care hospital for the purpose of avoiding central line-associated bloodstream infections (CLABSI). This assessment was conducted through the use of a questionnaire.

Materials and methods: A cross-sectional study was conducted in the ICU, involving doctors and nurses. The study was observational in nature. The study employed a methodical validated questionnaire to evaluate the level of knowledge, attitude, and practice of central line bundles for the prevention of central line-associated bloodstream infections (CLABSI). The questionnaire was designed using preexisting awareness surveillance systems, infection control measures, and patient care practices that were specifically relevant to CLABSIs in the ICU. The data were analyzed utilizing SPSS.

Results: The research involved a total of 93 healthcare professionals, consisting of 67 physicians and 26 nurses. The mean knowledge score among participants was 82%, with higher scores reported in individuals who had training in central line bundles. Healthcare professionals exhibited robust compliance with hand cleanliness, antiseptic skin preparation prior to insertion, aseptic draping of the patient, utilization of utmost sterile barriers, verification of central venous catheter (CVC) tip placement using chest X-ray or fluoroscopy, and preservation of a sterile environment.

Conclusion: The study emphasized the significance of training in enhancing understanding and adherence to central line bundling protocols in ICUs. Participants exhibited a high level of knowledge and commitment to recommended practices, indicating that this training can have a favorable effect on CLABSI rates.

Keywords: Central line-associated bloodstream infections, Central line bundle, Intensive care unit, Questionnaire.

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HIGHLIGHTS

An observational, cross-sectional questionnaire-based study was conducted in the ICU to assess the level of awareness and degree of implementation of central line bundles for the prevention of central line-associated bloodstream infections (CLABSIs) in doctors and nurses. The participant's average knowledge score was found to be 82% and which was higher in the central line bundle trained HCW.

INTRODUCTION

Health care-associated infections (HCAIs) are infections that patient acquires in healthcare echelons while undergoing treatment for another ailment.[1] In many nations around the world, the issue of HCAIs remains one of the most serious public health concern[2] and these infections continue to be a main cause of morbidity and mortality in hospitalized patients[3] along with an increase in the cost of treatment.[4] Healthcare-associated infection is also the most important factor that negatively affects the reputation and performance of a hospital, which puts undue pressure on the already strained resources of the patients, hospital, and community.[5]

Central line-associated bloodstream infections are the most common complication of central venous catheters (CVCs), with an incidence of 4.1 per 1,000 central line days.[6] Various studies from developed countries have shown that CLABSI are also responsible for increased treatment costs.[7] CLABSI can be mostly preventable, but they are still common due to lapses in sterile procedures during catheter insertion, administration of fluids, or central line maintenance.[7–9]

[1]Department of Hospital Administration, Command Hospital Air Force, Bengaluru, Karnataka, India

[2,3]Department of Anaesthesiology and Critical Care, Army Hospital (R&R), New Delhi, India

[4]Department of Lab Sciences, Command Hospital Air Force, Bengaluru, Karnataka, India

Corresponding Author: Seerat P Sharma, Department of Lab Sciences, Command Hospital Air Force, Bengaluru, Karnataka, India, Phone: +91 9989309728, e-mail: seeratpalsharma@gmail.com

Doctors and nurses are mainly responsible for the preparation, insertion, care and maintenance of the central line.[10] CLABSIs can be largely preventable when evidence-based guidelines for the preparation, insertion, and maintenance bundles of central line are followed meticulously.[11] In developed countries, most of the intensive care units (ICUs) are reporting zero to near zero CLABSI rates.[12]

It has been confirmed that implementation of central line bundles, which are the set of evidence-based interventions coupled with education and the commitment of both staff and institutions can reduce the incidence of CLABSIs.[13–16] According to Ullman et al.[17] pediatric ICU nurses in Australia and New Zealand had a wide range of knowledge, aptitude, and practice for preventing CVC-related infections, and many were not following guideline recommendations such as using maximum sterile barrier precautions, using suture-less securement devices, and changing transparent dressings at least every 7 days. The authors came to the conclusion that there was a need for a general improvement in knowledge of evidence-based guidelines. Bianco et al.[18] mentioned in their study that evidence-based policy and training can help doctors and nurses to improve their knowledge, practice, and attitude toward reducing CLABSIs.

Globally, several studies have proved a reduction of CLABSI rates after the utilization of central line bundles while using central lines.[18–19] A study published in 2017 reported 12.2% reduction in CLABSI rate after implementation of central line insertion and maintenance bundles in ICU.[18] Additionally, a study published in 2016 reported a 43% reduction in CLABSI after the introduction of the central line care maintenance bundle in non-ICU setting.[20]

Considering the grave nature of the condition, and importance knowledge and utilization of central line bundles by doctors and nurses in ICU, the present study was carried out to assess the level of awareness and degree of implementation of central line bundles for the prevention of CLABSI by a questionnaire-based study in the Medical and Surgical ICU of a Tertiary Care Hospital.

MATERIALS AND METHODS

Setting and Study Design

The study was carried out at the Medical and Surgical ICU of a tertiary care hospital in a metropolitan city, after receiving approval from the Institutional Ethics Committee. The study sought to evaluate the extent of knowledge and adherence to established measures for preventing CLABSIs among healthcare workers (HCWs). The study was intended as a single-worker, cross-sectional descriptive survey and follows the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) principles for reporting.[21]

Selection Criteria

The study included doctors and nurses who were responsible for central line bundle care in the hospital's ICU, which is the unit where patients with central lines were brought.

Calculation of Sample Size

The sample size was calculated using a G power sample size calculator, with a 95% confidence level and a maximum acceptable error of 0.05. In this questionnaire-based survey study, a total of 93 healthcare personnel were enrolled, consisting of 67 doctors and 23 nurses.[22]

Data Collection

The research team constructed the questionnaire, using the Centers for Disease Control and Prevention (CDC) Guidelines for the Prevention of Intravascular Catheter-related Infections as a basis.[3] The purpose of the questionnaire (Table 1) was to evaluate the extent of knowledge and the level of adherence to established

Table 1: Self-administered questionnaire

Study on level of awareness degree of implementation of existing protocols for prevention of CLABSI in Intensive Care Unit
I request you to kindly give us the information required for the study. It will be used for research purpose only and will be kept confidential. I thank you for your cooperation.
Part I: Sociodemographic details

Age: ………………
Sex: Male/Female
Profession: Doctor/Nurse
Highest Qualifications: Graduate/Postgraduate/Superspecialist
Years of Service: ………………

Questions related to CLABSI prevention practices

		Response tick the right option			
S. No.	Question	Yes	No	N/A or Not sure	Comment
Part II: Preparation bundle (before the procedure)					
1	Patient is educated about the need for and implications of the central line as well as the processes of insertion and maintenance				
2	Patient's latex/adhesive allergy assessed				
3	Patient's infection risk assessed. If at greater risk, why?				
4	Operator and Assistant used appropriate hand hygiene immediately				
5	Equipment assembled and verified—materials, medications, syringes, dressings, and labels				
6	Patient identified with two sources of identification				
7	Site assessed and marked				

(Contd...)

Table 1: *(Contd...)*

		Response tick the right option			
S. No.	Question	Yes	No	N/A or Not sure	Comment
8	Patient positioned for procedure				
9	Skin preparation performed with alcoholic chlorhexidine greater than 0.5% or tincture of iodine				
10	Skin preparation allowed to dry prior to puncture				
11	Patient's body covered by sterile drape from head to toe				
12	All those performing procedure using sterile gloves, sterile gown, hat/cap, mask, and eye protection/shield				
13	Others in room wearing mask				
14	Catheter preflushed and all lumens clamped				
15	Local anesthetic and/or sedation used __				
Part III: Insertion bundle (during insertion)					
16	Confirmation of venous placement prior to dilatation of vein by: Ultrasound/transesophageal echocardiogram/pressure transducer/manometry method/fluoroscopy				
17	Blood aspirated from each lumen (intravascular placement assessed)				
18	Catheter caps placed on lumens				
19	All lumens clamped (should not be done with neutral or positive displacement connectors)				
20	Catheter secured (sutured/stapled/steri-stripped)				
21	Tip position confirmation via fluoroscopy OR chest X-ray				
22	Sterile field maintained				
23	Blood cleaned from site				
24	Sterile dressing applied (gauze, transparent dressing, antimicrobial foam disc)				
Part IV: Maintenance bundle (after insertion)					
25	Injection sites are covered by caps or valved connectors				
26	Dressing dated				
27	Central line (maintenance) order placed				
28	Patient is educated about maintenance as needed				

protocols for preventing CLABSI among HCWs at the study site during the data collecting period. Prior to implementation, the system underwent rigorous validation by specialists and extensive field testing.

The survey comprised 28 questions that were categorized into four groups. The initial segment collected demographic and professional data regarding doctors and nurses, encompassing age, gender, educational attainment, years of professional experience, and occupational position. The second portion evaluated the understanding of evidence-based techniques for the preparation bundling of central lines in order to prevent CLABSIs. The topics covered in the training session encompassed patient education, evaluation of infection susceptibility, adherence to hand hygiene protocols by medical practitioners, patient identification, assessment of the surgical site, patient positioning, skin preparation, and the administration of local anesthesia. The response options included "affirmative," "negative," and "undecided."

The third section assessed knowledge regarding evidence-based practices for the insertion bundle of central lines. This included topics, such as verifying venous placement prior to vein dilation, evaluating intravascular placement, securing the catheter and clamping the lumen, confirming the positioning of the catheter tip, maintaining a sterile environment, and applying sterile dressings. The available response options were limited to "yes," "no," and "not sure."

The fourth component explored knowledge pertaining to evidence-based procedures for the maintenance management of central lines. These practices include the use of caps or valve connections to cover injection sites, the documentation of dates on dressings, the placement of maintenance orders for central lines, and the education of patients on maintenance and care. The identical response alternatives were utilized.

The questionnaire had a pilot test with a cohort of 20 oncology nurses for validation purposes. The ultimate iteration was enhanced and rectified in accordance with the feedback provided by the participants.

Data Analysis

The collected data were inputted into an Excel spreadsheet and then exported to SPSS (Statistical Package for Social Sciences) version 23 for analysis. The data were structured into tables, and an analysis was performed. The Chi-square test (2 × 2) was used to compare percentages. $p > 0.05$ was considered as level of significance.

RESULTS

Sociodemographic Characteristics of the Participants

The study obtained a response rate of 81%, with 93 questionnaires totally completed out of the 120. The survey participants consisted of 72.1% doctors and 27.9% nurses. The gender distribution

comprised 59.1% female and 40.9% male participants. The mean age of the participants was 40.1 years, with a standard deviation of 8.6 years (Table 2).

Knowledge Assessment: Preparation Bundle Practices

The findings unveiled substantial disparities in the understanding and compliance with evidence-based practices among healthcare professionals. Only a tiny proportion of doctors (4.4%) and nurses (7.7%) provided patients with information regarding central line procedures. A significant proportion of doctors (91%) and nurses (80.8%) did not inquire about a patient's history of latex or adhesive allergies. Additionally, a high percentage of doctors (94%) and nurses (92.4%) did not evaluate the risk of infection prior to insertion. Nevertheless, there was a significant level of adherence observed in several areas, such as hand hygiene (98.5% of doctors and 88.5% of nurses) and equipment preparation (98.5% of doctors and 92.4% of nurses).

More than 85% of doctors and nurses said that they consistently used at least two sources to accurately identify patients. Similarly, a significant proportion adhered to guidelines for doing site assessments and marking, situating patients, and preparing the skin with antiseptic treatments. Almost all individuals utilized sterile drapes and personal protective equipment (PPE). Significantly, a mere 52.2% of doctors and a higher proportion of nurses (65.4%) indicated that they wore masks while performing insertion. The act of preflushing catheters to assess their openness and the utilization of local anesthetic were commonly adhered to (Table 3).

Knowledge Assessment: Best Practices for Maintenance Bundles

The maintenance phase exhibited diverse degrees of commitment to the program. A considerable proportion of healthcare professionals failed to verify venous placement prior to vein dilation; however, the majority did evaluate intravascular location by extracting blood from each lumen. The majority continuously adhered to practices, such as the utilization of catheter caps, clamping of lumens, and securement. All clinicians universally confirmed the location of the catheter using fluoroscopy or chest X-ray.

All respondents adhered to conventional norms of maintaining a clean field and applying sterile dressings. Nevertheless, a mere fraction (16.2%) of respondents acknowledged providing patients with information regarding central line maintenance, suggesting a deficiency in patient-centered care protocols. Overall, the results

Table 2: Sociodemographic characteristics of the responders

Factors	Number of respondents	Percentage (%)
Profession		
Doctor	67	72.1
Nurse	26	27.9
Gender		
Female	55	59.1
Male	38	40.9
Age-group (years)		40.1 ± 8.6 (25–60)*
<35	23	24.8
36–40	21	22.6
41–45	20	21.5
46–50	17	18.2
>50	12	12.9
Highest qualification		
Graduate	27	29
Postgraduate	48	51.6
Superspecialist	18	19.4
Years of service (years)		9.8 ± 8.6 (1–35)*
1–5	6	6.3
6–10	27	27.6
11–15	32	34.9
16–20	18	19.8
>20	10	11.4

*Mean ± Standard deviation (range)

Table 3: Preparation bundle

	Preparation bundle (before the procedure)								
Sl No.	Respondents								
Question	Doctors			Nurses			Total		
	Yes	No	N/A	Yes	No	N/A	Yes	No	N/A
No.1	3 (4.4%)	59 (88.2%)	5 (7.4 %)	2 (7.7%)	21 (80.8 %)	3 (11.5%)	5 (5.4%)	80 (86%)	8 (8.6 %)
No.2	4 (6%)	61 (91%)	2 (3%)	2 (7.7%)	21 (80.8 %)	3 (11.5%)	6 (6.4%)	82 (88.2%)	5 (5.4%)
No.3	1 (1.5%)	63 (94%)	3 (4.5%)	1 (3.8%)	24 (92.4%)	1 (3.8%)	2 (2.1%)	87 (93.5%)	4 (4.4%)
No.4	66 (98.5%)	0 (0%)	1 (1.5%)	23 (88.5%)	2 (7.7%)	1 (3.8%)	89 (95.8%)	2 (2.1%)	2 (2.1%)
No.5	66 (98.5%)	1 (1.5%)	0 (0%)	24 (92.4%)	1 (3.8%)	1 (3.8%)	90 (96.8%)	2 (2.1%)	1 (1.1%)
No.6	57 (85.1%)	8 (11.9%)	2 (3%)	22 (84.6%)	4 (15.4%)	0 (0%)	79 (84.9%)	12 (12.9%)	2 (2.2%)
No.7	64 (95.5%)	2 (3%)	1 (1.5%)	23 (88.5%)	1 (3.8%)	2 (7.7%)	87 (93.6%)	3 (3.2%)	3 (3.2%)
No.8	62 (92.5%)	4 (6%)	1 (1.5%)	21 (80.8%)	3 (11.5%)	2 (7.7%)	83 (89.2%)	7 (7.5%)	3 (3.3%)
No.9	67 (100%)	0 (0%)	0 (0%)	25 (96.2%)	0 (0%)	1 (3.8%)	92 (98.9%)	0 (0%)	1 (1.1%)
No.10	49 (73.1%)	13 (19.4%)	5 (7.5%)	17 (65.4%)	6 (23.1%)	3 (11.5%)	66 (71%)	19 (20.4%)	8 (8.6%)
No.11	67 (100%)	0 (0%)	0 (0%)	25 (96.2%)	0 (0%)	1 (3.8%)	92 (98.9%)	0 (0%)	1 (1.1%)
No.12	67 (100%)	0 (0%)	0 (0%)	26 (100%)	0 (0%)	0 (0%)	93 (100%)	0 (0%)	0 (0%)
No.13	35 (52.5%)	24 (35.8%)	8 (12%)	17 (65.4%)	6 (23.1%)	3 (11.5%)	52 (55.9%)	30 (32.2%)	11 (11.9%)
No.14	66 (98.5%)	0 (0%)	1 (1.5%)	19 (73.1%)	4 (15.4%)	3 (11.5%)	85 (91.4%)	4 (4.3%)	4 (4.3%)
No.15	67 (100%)	0 (0%)	0 (0%)	25 (96.1%)	0 (0%)	1 (3.9%)	92 (98.9%)	0 (0%)	1 (1.1%)

indicated that there was generally good adherence to certain procedural features. However, the data also emphasize the need for improvement in patient education and specific preparation measures, as seen in Tables 4 and 5.

DISCUSSION

This study conducted a prospective evaluation of the level of consciousness and the extent to which central line bundle protocols are put into practice by HCWs in a tertiary care hospital. The findings demonstrated a significant level of consciousness and execution, with participants attaining an average knowledge score of 82%, as depicted in Table 6. This finding demonstrates a much higher value when compared with other research, such as by Shah et al., which revealed an average score of 74% among ICU nurses who used a comparable questionnaire.[23] Conversely, a study conducted in Brazil revealed a knowledge score of 42%, with a significant number of HCWs expressing a deficiency in training for central line bundles.[24] The participants' high results in our study can be linked to the comprehensive training they got, highlighting the significance of ongoing education.[24–27]

The importance of training and instruction in the preparation, insertion, and management of central lines cannot be emphasized enough. Around 75% of the medical professionals in our study had received training, either through in-house programs or online, on central line bundle protocols. Multiple studies provide evidence for the positive link between training and the acquisition of information. An educational program that was put into effect in 2013 showed that after the training, staff members were able to answer 99% of questions correctly, compared with only 60% before the training. A separate study conducted in 2015 inside cardiac ICUs demonstrated a decrease

in CLABSI rates from 3.4 to 1.2 infections per 1000 central line days after using an educational intervention.[25] Similarly, a study conducted in 2019 within an ICU demonstrated a significant 48% decrease in CLABSI rates, highlighting the effectiveness of ongoing teaching.[26]

Our study revealed that doctors exhibited superior adherence to hand hygiene practices compared with nurses, which is in contrast to a study conducted by El-Saed et al. in Saudi Arabia, where nurses displayed higher rates of compliance. Nurses play a vital role in maintaining central lines, and providing them with advanced training could boost their ability to ensure compliance and decrease incidence of (CLABSI).[27]

Regarding procedural methods, 98.9% of the participants in our survey indicated use antiseptic solutions such as alcoholic chlorhexidine or tincture of iodine for skin preparation prior to central line installation. Ensuring thorough skin disinfection is crucial for preventing the introduction of microorganisms and the subsequent development of CLABSI. Meta-analyses have demonstrated that chlorhexidine is superior to povidone-iodine in lowering the incidence of CLABSI, most likely because of its longer-lasting effect.[28,29]

Limitations

Although this study offers significant information, it does have certain drawbacks. The use of observational design and dependence on self-reported data may induce bias. Moreover, the research was carried out exclusively in a solitary tertiary care facility, which restricts the applicability of the results.

Future

Subsequent investigations should strive to incorporate a broader and more varied sample from other institutions in order to augment

Table 4: Insertion bundle

SI No.	Insertion bundle (during insertion)								
	Respondents								
Question	Doctors			Nurses			Total		
	Yes	No	N/A	Yes	No	N/A	Yes	No	N/A
No.16	0 (0%)	65 (97%)	2 (3%)	1 (3.8%)	2 (7.7%)	23 (88.5%)	1 (1.1%)	67 (72%)	25 (26.9%)
No.17	66 (98.5%)	1 (1.5%)	0 (0%)	18 (69.2%)	2 (7.7%)	6 (23.1%)	84 (90.3%)	3 (3.2%)	6 (6.5%)
No.18	66 (98.5%)	0 (0%)	1 (1.5%)	24 (92.4%)	1 (3.8%)	1 (3.8%)	90 (96.7%)	1 (1.1%)	2 (2.2%)
No.19	65 (97%)	1 (1.5%)	1 (1.5%)	23 (88.5%)	2 (7.7%)	1 (3.8%)	88 (94.7%)	3 (3.2%)	2 (2.1%)
No.20	66 (98.5%)	0 (0%)	1 (1.5%)	19 (73%)	2 (7.7%)	5 (19.3%)	85 (92.4%)	2 (2.1%)	6 (5.5%)
No.21	67 (100%)	0 (0%)	0 (0%)	23 (88.5%)	1 (3.8%)	2 (7.7%)	90 (96.8%)	1 (1.1%)	2 (2.1%)
No.22	67 (100%)	0 (0%)	0 (0%)	26 (100%)	0 (0%)	0 (0%)	93 (100%)	0 (0%)	0 (0%)
No.23	66 (98.5%)	0 (0%)	1 (1.5%)	26 (100%)	0 (0%)	0 (0%)	92 (98.9%)	0 (0%)	1 (1.1%)
No.24	67 (100%)	0 (0%)	0 (0%)	26 (100%)	0 (0%)	0 (0%)	93 (100%)	0 (0%)	0 (0%)

Table 5: Maintenance bundle

SI No.	Maintenance bundle (after insertion)								
	Respondents								
Question	Doctors			Nurses			Total		
	Yes	No	N/A	Yes	No	N/A	Yes	No	N/A
No.25	66 (98.5%)	0 (0%)	1 (1.5%)	26 (100%)	0 (0%)	0 (0%)	92 (98.9%)	0 (0%)	1 (1.1%)
No.26	65 (97%)	1 (1.5%)	1 (1.5%)	23 (88.5%)	1 (3.8%)	2 (7.7%)	88 (94.7%)	2 (2.1%)	3 (3.2%)
No.27	63 (94%)	1 (1.5%)	3 (4.5%)	18 (69.3%)	3 (11.5%)	5 (19.2%)	81 (87.1%)	4 (4.3%)	8 (8.6%)
No.28	11 (16.4%)	41 (61.2%)	15 (22.4%)	4 (15.4%)	13 (50%)	9 (34.6%)	15 (16.2%)	54 (58.1%)	24 (25.7%)

Table 6: Knowledge of healthcare workers

Poor knowledge of HCW Q. no.	Question	% of Awareness
1	Patient is educated about the need for and implications of the central line as well as the processes of insertion and maintenance.	5.4%
2	Patient's latex/adhesive allergy assessed	6.4%
3	Patient's infection risk assessed. If at greater risk, why?	2.1%
16	Confirmation of venous placement prior to dilatation of vein by: ultrasound/ transesophageal echocardiogram / pressure transducer / manometry method / fluoroscopy	1.1%
28	Patient is educated about maintenance as needed	16.2%
Average knowledge of HCW		
13	Others in room wearing mask	55.9%
Good knowledge of HCW		
6	Patient identified with two sources of identification	84.9%
7	Site assessed and marked	93.6%
8	Patient positioned for procedure	89.2%
10	Skin preparation allowed to dry prior to puncture	71%
14	Catheter preflushed and all lumens clamped	91.4%
17	Blood aspirated from each lumen (intravascular placement assessed)	90.3%
19	All lumens clamped (should not be done with neutral or positive displacement connectors)	94.7%
20	Catheter secured (sutured /stapled /steri-stripped)	92.4%
26	Dressing dated	94.7%
27	Central line (maintenance) order placed	87.1%
Excellent knowledge of HCW		
4	Operator and Assistant used appropriate hand hygiene immediately	95.8%
5	Equipment assembled and verified—materials, medications, syringes, dressings, and labels	96.8%
9	Skin preparation performed with alcoholic chlorhexidine greater than 0.5% or tincture of iodine	98.9%
11	Patient's body covered by sterile drape from head to toe	98.9%
12	All those performing procedure using sterile gloves, sterile gown, hat/cap, mask, and eye protection/shield	100%
15	Local anesthetic and /or sedation used	98.9%
18	Catheter caps placed on lumens	96.7%
21	Tip position confirmation via fluoroscopy OR chest X-ray	96.8%
22	Sterile field maintained	100%
23	Blood cleaned from site	98.9%
24	Sterile dressing applied (gauze, transparent dressing, gauze and transparent dressing, antimicrobial foam disc)	100%
25	Injection sites are covered by caps or valved connectors	98.9%

the generalizability of the results. Conducting longitudinal studies to assess the long-term effects of ongoing training programs on CLABSI rates would be advantageous. Moreover, investigating the obstacles to applying optimal methods among various HCW cohorts could yield specific tactics to improve adherence and decrease infection rates.

Summary and Conclusion

This study highlights the significant level of understanding and adherence to central line bundle protocols among healthcare staff in a tertiary care ICU, as evidenced by an average knowledge score of 82%. The training was recognized as a crucial element in improving knowledge and adherence, resulting in a considerable influence on CLABSI rates. Nevertheless, the study emphasizes the necessity for continuous education and focused interventions to tackle deficiencies in practice, specifically among nurses. The results support the need for the development of training programs and ongoing review to maintain high standards in infection prevention. Additional study is required to apply these findings universally and enhance patient safety.

Orcid

Shailendra Singh https://orcid.org/0000-0002-6613-0540
Abhishek Sharma https://orcid.org/0000-0003-0709-6298
Manish Dhawan https://orcid.org/0000-0001-7537-0100
Seerat P Sharma https://orcid.org/0000-0002-6529-3807

References

1. Siegel JD, Rhinehart E, Jackson M, Chiarello L; Health Care Infection Control Practices Advisory Committee. 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings. Am J Infect Control. 2007;35 (10 Suppl 2): S65–164. DOI: 10.1016/j.ajic.2007.10.007.
2. Vaz LE, Kleinman KP, Kawai AT, Jin R, Kassler WJ, Grant PS, et al. Impact of Medicare's Hospital-Acquired Condition policy on infections in safety net and non-safety net hospitals. Infect Control Hosp Epidemiol 2015;36(6):649–655. DOI: 10.1017/ice.2015.38.
3. Centers for Disease Control and Prevention. Progress report on healthcare-associated infections [Internet]. Available from: https://www.cdc.gov/healthcare-associated-infections/php/data/progress-report.html. Accessed July 25, 2024.

4. Saint S, Greene MT, Krein SL, Fowler KE, Linder KA, Ratz D, et al. What US hospitals are doing to prevent common device-associated infections during the coronavirus disease 2019 (COVID-19) pandemic: Results from a national survey in the United States. Infect Control Hosp Epidemiol 2023;44(12):1913–1919. DOI: 10.1017/ice.2023.65.

5. World Health Organization. Guidelines on Prevention and Control of Hospital-Associated Infections: A Practical Guide. 2nd ed. Geneva: World Health Organization; 2002. Accessed July 25, 2024.

6. Rosenthal VD, Al-Abdely HM, El-Kholy AA, AlKhawaja SAA, Leblebicioglu H, Mehta Y, et al. International Nosocomial Infection Control Consortium report, data summary of 50 countries for 2010–2015: Device-associated module. Am J Infect Control 2016;44(12):1495–1504. DOI: 10.1016/j.ajic.2016.08.007.

7. Ranji SR, Shetty K, Posley KA. Closing the quality gap: A critical analysis of quality improvement strategies. Vol. 6: Prevention of Healthcare-Associated Infections. Rockville (MD): Agency for Healthcare Research and Quality (US); 2007. Technical Reviews, No. 9.6.1. Accessed July 25, 2024.

8. Bukhari S, Banjar A, Baghdadi S, Baltow B, Ashshi A, Hussain W. Central line associated blood stream infection rate after intervention and comparing outcome with national healthcare safety network and international nosocomial infection control consortium data. Ann Med Health Sci Res 2014;4(5):682–686. DOI: 10.4103/2141-9248.141499.

9. Mermel LA. What is the predominant source of intravascular catheter infections? Clin Infect Dis 2011;52 (2):211–212. DOI: 10.1093/cid/ciq108.

10. Butler R, Monsalve M, Thomas GW, Herman T, Segre AM, Polgreen PM, et al. Estimating time physicians and other health care workers spend with patients in an intensive care unit using a sensor network. Am J Med 2018;131(8):972.e9–972.e15. DOI: 10.1016/j.amjmed.2018.03.015.

11. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med 2006;355(26):2725–2732. DOI: 10.1056/NEJMoa061115. Erratum in: N Engl J Med 2007;356(25):2660.

12. Ling ML, Apisarnthanarak A, Jaggi N, Harrington G, Morikane K, Thu le TA, et al. APSIC guide for prevention of Central Line Associated Bloodstream Infections (CLABSI). Antimicrob Resist Infect Control 2016;5:16. DOI: 10.1186/s13756-016-0116-5.

13. Zeng C, Wu A, Li L, Jia H. Multi-center prospective study on central line-associated bloodstream infections in 79 ICUs of China. BMC Infect Dis 2021;21(1):1208. DOI: 10.1186/s12879-021-06871-5.

14. McLaws ML, Burrell AR. Zero risk for central line-associated bloodstream infection: are we there yet? Crit Care Med 2012;40(2):388–393. DOI: 10.1097/CCM.0b013e318232e4f3.

15. Shuman EK, Washer LL, Arndt JL, Zalewski CA, Hyzy RC, Napolitano LM, et al. Analysis of central line-associated bloodstream infections in the intensive care unit after implementation of central line bundles. Infect Control Hosp Epidemiol 2010;31(5):551–553. DOI: 10.1086/652157.

16. Perin DC, Erdmann AL, Higashi GDC, Dal Sasso GTM. Evidence for care to prevent central venous catheter-related bloodstream infection: A systematic review. Rev Lat Am Enfermagem 2016;24(2):2787–2795. DOI: 10.1590/1518-8345.1233.2787.

17. Ullman AJ, Long DA, Rickard CM. Prevention of central venous catheter infections: A survey of paediatric ICU nurses' knowledge and practice. Nurse Educ Today 2014 ;34(2):202–207. DOI: 10.1016/j.nedt.2013.09.002.

18. Bianco A, Coscarelli P, Nobile CG, Pileggi C, Pavia M. The reduction of risk in central line-associated bloodstream infections: Knowledge, attitudes, and evidence-based practices in health care workers. Am J Infect Control 2013;41(2):107–112. DOI: 10.1016/j.ajic.2012.02.038.

19. Lai CC, Cia CT, Chiang HT, Kung YC, Shi ZY, Chuang YC, et al. Infection Control Society of Taiwan. Implementation of a national bundle care program to reduce central line-associated bloodstream infections in intensive care units in Taiwan. J Microbiol Immunol Infect 2018;51(5):666–671. DOI: 10.1016/j.jmii.2017.10.001.

20. O'Neil C, Ball K, Wood H, McMullen K, Kremer P, Jafarzadeh SR, et al. A Central line care maintenance bundle for the prevention of central line-associated bloodstream infection in non-intensive care unit settings. Infect Control Hosp Epidemiol 2016;37(6):692–698. DOI: 10.1017/ice.2016.32.

21. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol 2008;61(4):344–349. DOI: 10.1016/j.jclinepi.2007.11.008.

22. O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, et al. Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the prevention of intravascular catheter-related infections. Clin Infect Dis 2011;52(9):e162–193. DOI: 10.1093/cid/cir257.

23. Shah M, Qasim M. Practice of nursing care for central venous catheter among ICUS nurses in private tertiary care hospital Peshawar, KP. J Nurs Health Care 2017;2(2):1–8. DOI: 10.19080/JOJNHC.2017.02.555585.

24. Silva A, Oliveira A. Medical and nursing team self-reported knowledge on blood stream infection prevention measures. Texto Contexto Enfermagem 2018;27(3):e3480017.

25. Williams D. Use of a policy-driven education program to reduce central line-associated bloodstream infection rates. J Infus Nurs 2015;38 (1):63–68. DOI: 10.1097/NAN.0000000000000076.

26. Acharya R, Bedanta Mishra S, Ipsita S, Azim A. Impact of Nursing Education on CLABSI Rates: An Experience from a Tertiary Care Hospital in Eastern India. Indian J Crit Care Med 2019;23 (7):316–319. DOI: 10.5005/jp-journals-10071-23205.

27. El-Saed A, Noushad S, Tannous E, Abdirizak F, Arabi Y, Al Azzam S, et al. Quantifying the Hawthorne effect using overt and covert observation of hand hygiene at a tertiary care hospital in Saudi Arabia. Am J Infect Control 2018;46(8):930–935. DOI: 10.1016/j.ajic.2018.02.025.

28. Hanson D. Reducing Central Line-Associated Bloodstream Infection Rates in the Context of a Caring-Healing Environment: A Patient Safety Program Evaluation. J Infus Nurs 2017;40(2):101–110. DOI: 10.1097/NAN.0000000000000212.

29. Macias JH, Arreguin V, Munoz JM, Alvarez JA, Mosqueda JL, Macias AE. Chlorhexidine is a better antiseptic than povidone iodine and sodium hypochlorite because of its substantive effect. Am J Infect Control 2013;41(7):634–637. DOI: 10.1016/j.ajic.2012.10.002.