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Major Article

Effects of organizational and individual factors on nurses' practice of central line-associated bloodstream infection prevention

Min Hee Kim RN, MPH, ICAPN [a], Jeong Sil Choi RN, MPH, PhD, ICAPN [b,*]

[a] The Gachon University Gil Hospital, Nursing Department, Incheon, South Korea
[b] Gachon University, College of Nursing, Incheon, South Korea

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Background: This study explored rarely investigated organizational factors (resource support and organizational culture) in conjunction with well-established individual factors (demographic characteristics, knowledge, and awareness) that impact nurses' practice of central line-associated bloodstream infection (CLABSI) prevention.

Methods: Self-reported questionnaire data were collected from 173 nurses recruited from departments that use central venous catheters (ie, intensive care units, emergency rooms, hemodialysis rooms, and oncology wards) in tertiary hospitals in South Korea. Multiple regression analyses were performed to examine the effects of individual and organizational factors.

Results: Organizational culture (ß = 0.350) had the greatest association with CLABSI prevention practice, followed by awareness (ß = 0.328) and department (ß = −0.217; all ps < 0.01). These variables explained 41.1% of the variance in CLABSI prevention practice (F = 20.996, $P < .001$). Higher self-reported CLABSI prevention practice was associated with a favorable organizational culture and higher awareness. Emergency room nurses' CLABSI prevention practice was notably inferior as compared to nurses in other departments.

Discussion: Organizational culture is the most significant factor affecting nurses' practice of CLABSI prevention.

Conclusions: An organizational culture with environmental improvements and resource support as well as infection prevention education and awareness-building programs should be fostered.

BACKGROUND

The increasing use of invasive devices and procedures in health care facilities has been the cause of various health care–associated infections.[1] Health care–associated infections include those caused by catheter use, such as central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection, and ventilator-associated pneumonia.[2]

Bloodstream infections prolong hospital stays, inflate medical costs, increase mortality rates, and negatively affect patients' quality of life.[2] CLABSI is the most common bloodstream infection, and central venous catheters (CVCs) are frequently the main cause.[2] Despite major efforts, it has been challenging to reduce the incidence of CLABSI in intensive care units (ICUs)[3] because of the diverse applications of CVCs, such as drug delivery, nutritional support, intravascular procedures, and dialysis. In addition to ICUs, oncology wards, hemodialysis rooms, and emergency departments often use CVCs.[4] CLABSI can be reduced in ICUs and other departments by implementing interventions such as bundles for the prevention of CLABSI.[5,6]

However, previous studies on CLABSI prevention have mainly concentrated on ICUs and emergency rooms, neglecting other departments that utilize CVCs.[7–9] In South Korea, most studies have focused on ICU nurses' knowledge and adherence to CLABSI prevention practices and the bundles for the prevention of CLABSI.[7,8] Globally, most research revolves around CLABSI in ICUs[9] and examines nurses' knowledge, attitudes, practice, and compliance with guidelines, as well as physicians' adherence to the bundles for the prevention of CLABSI during insertion.[6–10] Both domestic and international research on CLABSI indicate that improved knowledge and awareness correspond to higher practice, underscoring the importance of continuous education and training.[7,10]

* Address correspondence to Jeong Sil Choi, RN, MPH, PhD, ICAPN, College of Nursing, Gachon University, 191 Hambakmoero, Yeonsu-gu, Incheon 21936, Republic of Korea.
E-mail address: jschoi408@empas.com (J.S. Choi).
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In addition to individual factors, such as knowledge and awareness, it is critical to consider organizational factors that affect the practice of CLABSI prevention.[11,12] Organizational culture is the set of values, beliefs, attitudes, systems, and rules that outline and influence employee behavior within an organization.[11,12] Resource support was identified as a significant factor affecting nurses' provision of person-centered care for COVID-19 in small- to medium-sized hospitals.[13] Another study that explored emergency room nurses' knowledge and practice of infection control observed a positive correlation between organizational culture and infection control practice.[14] Evidently, resource support and organizational culture significantly enhance practice.[11–14] However, research on the practice of CLABSI prevention has mainly focused on variables related to demographic characteristics and knowledge and awareness.[6–10]

To address this gap, this study focused on nurses who play a vital role in managing and maintaining CVCs in tertiary hospitals[15] that perform complex medical procedures on critically ill patients.[16] Specifically, nurses' infection control practice was evaluated not only in ICUs and emergency rooms but also in other departments where CVCs are commonly used. As independent variables, both individual (demographic characters, knowledge, and awareness) and organizational factors (resource support and organizational culture) were considered.

METHODS

Design and sampling

This study employed a descriptive survey design to examine the impact of individual (demographic characters, knowledge, and awareness) and organizational factors (resource support and organizational culture) on CLABSI prevention practice among nurses in tertiary hospitals.

Participants were nurses working in ICUs, emergency rooms, hemodialysis rooms, and cancer wards, which frequently use CVCs,[14] in 2 tertiary hospitals in Incheon, South Korea. Excluding head nurses and new nurses in training who could not perform their duties alone, only those who voluntarily agreed to participate completed the survey. Anonymity was maintained throughout the study period.

The required sample size was determined by G*Power to be 150, based on a multiple regression analysis with significance level = 0.05, power = 0.80, effect size = 0.15, and 18 independent variables. Considering a dropout rate of 20% (in line with prior studies[7,8]), the required sample size was 188.

This study was approved by G-University's Institutional Review Board (no. 1044396-202201-HR-001-01) and conducted from April 2022 to February 2023. With permission from the nursing departments and head nurses of the respective departments, surveys were disseminated via a URL to the ICUs, emergency rooms, hemodialysis rooms, and cancer wards. Responses were collected in August 2022. The purpose and procedure of the research were explained in the survey, and only those who voluntarily agreed to participate completed it. The survey took approximately 10 minutes. Of the 188 nurses, 181 provided data (96.3% response rate). Eight were discarded owing to missing responses; thus, the data from 173 participating nurses were analyzed.

Measures

The questionnaire was divided into 2 factors: the individual factors comprised demographic characteristics, knowledge, and awareness; while the organizational factors included resource support and organizational culture. We employed the demographic characteristics related to CVC care that were utilized in previous studies (CVC dressing and sample frequency, CVC use type, average number of CVC patients).[3,5–8]

Knowledge of CLABSI prevention was evaluated using modified versions of the CLABSI prevention scale developed by Ha et al[8] and the Easy-to-Understand Infection Control 2nd Edition (2021).[17] Fifteen items were used. The content validity of the items was established by an expert panel of 3 infection control nurses and 1 nursing professor. The content validity index (CVI) was 0.95. The knowledge scores were based on the percentage of correct responses. Regarding nurses' knowledge of CVC practice, there were 3 possible responses: "correct" (1 point), "incorrect" (0 points), and "do not know" (0 points). The Kuder–Richardson formula 20 was used to assess the reliability of the tool, which yielded a score of 0.50.

Awareness of CLABSI prevention was evaluated using the five-item Central Line Bundle Awareness survey tool developed by Kim,[7] after adjusting it to a five-point Likert scale (1 = *not at all important*, 2 = *not important*, 3 = *average*, 4 = *important*, and 5 = *very important*). Higher scores indicated a higher level of awareness. The CVI was 0.95, and Cronbach's α was 0.50.

Nurses' CLABSI prevention practices were evaluated using 12 items from the guidelines by the Korea Disease Control and Prevention Agency[19] and the practice of CLABSI prevention by Ha et al[8] The items were revised, and the CVI was 0.92. Each item was rated on a five-point Likert scale (1 = *never*, 2 = *rarely*, 3 = occasionally, 4 = *frequently*, and 5 = *always*), with higher scores indicating higher levels of practice. Cronbach's α for the tool was 0.77, indicating acceptable internal consistency.

Resource support for CLABSI prevention was evaluated using 11 items developed by Moon and Jang[18] The CVI was 0.94. Each item was rated on a five-point Likert scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*), with higher scores reflecting a higher level of resource support. Cronbach's α for the tool was 0.92, indicating excellent internal consistency.

Organizational culture related to CLABSI prevention was assessed using a 10-item infection control-related organizational culture measurement tool developed by Moon and Jang[18] Each item was rated on a five-point Likert scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*), with higher scores signifying a stronger perception of organizational culture. The fourth item, phrased negatively, was reverse-scored in the final summation. The CVI was 0.93 and Cronbach's α was 0.78, indicating acceptable internal consistency.

Data analysis

Data analysis was performed using the SPSS (IBM) WIN 23.0 program. Participants' demographic characteristics were analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation. Knowledge, awareness, practice of CLABSI prevention, resource support, and organizational culture were analyzed using descriptive statistics such as mean and standard deviation, and their normal distributions were confirmed by testing for normality. The differences in the practice of CLABSI prevention according to demographic characteristics were analyzed using independent t tests and a one-way analysis of variance. Scheffé's test was used for post hoc analyses. Pearson's correlation analysis was performed for correlations between knowledge, awareness, practice of CLABSI prevention. Resource support, and organizational culture. Finally, multiple regression analyses were performed using variables that showed significance in the previous tests to identify factors that affect the practice of CLABSI prevention.

Table 1
Demographic characteristics and differences in the mean score for the practice of CLABSI prevention (N = 173)

Characteristic	Category	n (%)	Score for the practice of CLABSI prevention	
			M ± SD	t or F (*p*)
Education	Professional degree	20 (11.6)	4.77 ± 0.30	1.80 (0.168)
	Bachelor's	135 (78)	4.61 ± 0.39	
	Master's	18 (10.4)	4.68 ± 0.32	
Work department	Intensive care unit[a]	70 (40.5)	4.70 ± 0.32	6.31 (< 0.001)*
	Emergency room[b]	13 (7.5)	4.17 ± 0.54	b < a, c, d, e
	Hemodialysis room[c]	24 (13.9)	4.65 ± 0.32	
	Cancer ward[d]	27 (15.6)	4.70 ± 0.33	
	Others[e]	39 (22.5)	4.64 ± 0.38	
Shift pattern	Full-time	13 (7.5)	4.72 ± 0.26	0.38 (.685)
	Shift work (night shift)	138 (79.8)	4.63 ± 0.39	
	Shift work (non-night shift)	22 (12.7)	4.65 ± 0.32	
CVC dressing frequency	None	13 (7.5)	4.61 ± 0.51	1.56 (.213)
	Sometimes	45 (26)	4.46 ± 0.41	
	Frequently	115 (66.5)	4.67 ± 0.34	
CVC sample frequency	None	8 (4.6)	4.41 ± 0.58	1.63 (.199)
	Sometimes	89 (51.4)	4.65 ± 0.36	
	Frequently	76 (43.9)	4.65 ± 0.37	
CVC use type	PICC	142 (82.1)	4.67 ± 0.35	1.71 (.168)
	Implanted port (chemo port)	2 (1.2)	4.38 ± 0.06	
	Non-tunneled catheter (subclavian, jugular, femoral)	24 (13.9)	4.50 ± 0.50	
	Tunneled catheter (Hickman, Perm cath)	5 (2.9)	4.58 ± 0.51	
Infection control education	Yes	128 (74)	4.67 ± 0.33	3.79 (.054)
	No	45 (26)	4.54 ± 0.48	
Existence of infection control guidelines	Yes	151 (87.3)	4.64 ± 0.37	0.02 (.890)
	No	22 (12.7)	4.63 ± 0.41	

NOTE. *Scheffé 's test.
CVC, central venous catheter; *CLABSI*, central line-associated bloodstream infection; *PICC*, peripherally inserted central catheter; *M*, mean; *SD*, standard deviation.

RESULTS

Participants' demographic characteristics

Most participating nurses worked in ICUs. Of the nurses, 66.5% and 43.9% had experience with CVC dressing and blood sampling, respectively. The most commonly used CVC was a peripherally inserted central catheter (82.1%). The average number of patients with CVC assigned per nurse was 1.28 ± 0.68, with 1 to 3 being the most common range (82.7%). Of the participants, 74% had received infection control education, and 87.3% had access to infection control guidelines (Table 1).

Differences in the practice of CLABSI prevention based on demographic characteristics

Practice of CLABSI prevention differed significantly according to department (F = 6.306). Scheffé's post hoc test showed that emergency room nurses had a significantly lower mean score compared to nurses in other departments (Table 1).

Level of knowledge, awareness, practice of CLABSI prevention, resource support, and organizational culture

The mean score for knowledge was 80.2 ± 0.1 (out of 100 points), 4.77 ± 0.30 (out of 5 points) for awareness, and 4.64 ± 0.38 (out of 5 points) for the practice of CLABSI prevention. The mean resource support score was 4.48 ± 0.68 (out of 5 points), with "Items necessary to comply with the central venous infection control guidelines can be easily used anytime, anywhere" scoring the highest (4.52 ± 0.74). The lowest-scoring item was "There is a system that stops insertion if the CVC is not inserted through appropriate procedures" (3.30 ± 1.39).

The mean organizational culture score was 4.19 ± 0.55 (out of 5 points). The highest-scoring item was "Compliance with the hospital's infection control guidelines is a normal task of the department"

Table 2
Level of knowledge, awareness, practice of CLABSI prevention, resource support, and organizational culture (N = 173)

Variables (possible range)	Mean ± SD
Knowledge (0%-100%)	80.2 ± 0.1
Awareness (1-5)	4.77 ± 0.30
Practice of CLABSI prevention (1-5)	4.64 ± 0.38
Resource support (1-5)	4.48 ± 0.68
Items necessary to comply with the central venous infection control guidelines can be easily used anytime, anywhere (eg, catheter selection with various ports and types of lumen as required/2% chlorhexidine with alcohol/MBP set upon insertion)	4.52 ± 0.74*
There is a system that stops insertion if the central venous catheter is not inserted through appropriate procedures	3.30 ± 1.39*
Organizational culture (1-5)	4.19 ± 0.55
Compliance with the hospital's infection control guidelines is a normal task	4.86 ± 0.38*
My immediate supervisor wants to get the job done quickly, even if they skip the infection control guidelines when they have a heavy workload (reverse-scored)	2.55 ± 1.62*

*The lowest or highest-scoring item in the subscales.

Table 3
Correlations between the practice of CLABSI prevention and study variables (N = 173)

Variable	1	2	3	4	5	6	7	8	9	10
	Pearson correlation value									
1. Practice	1.00									
2. Age	0.05	1.00								
3. Work experience	0.08	0.84**	1.00							
4. Department experience	-0.05	0.40**	0.50**	1.00						
5. Assigned patient	0.06	0.20**	0.20**	0.14	1.00					
6. Patient with CVC assigned	0.15*	0.04	0.04	0.01	0.09	1.00				
7. Knowledge	0.22**	0.47	0.06	-0.06	-0.06	-0.09	1.00			
8. Awareness	0.44**	0.15*	0.20*	0.10	-0.15	0.12	0.38**	1.00		
9. Resource support	0.32**	0.21*	0.24*	-0.02	0.11	0.05	0.17*	0.13	1.00	
10. Organizational culture	0.52**	-0.04	-0.02	-0.12	0.03	0.05	0.16*	0.22**	0.50**	1.00

NOTE. *$P < .05$ **$P < .01$.
CVC, central venous catheter.

(4.86 ± 0.38). The lowest-scoring item was "My immediate supervisor (the head nurse or responsible nurse) wants to get the job done quickly, even if they skip the infection control guidelines when they have a heavy workload" (2.55 ± 1.62; Table 2).

Correlations between the practice of CLABSI prevention, individual factors, and organizational factors

Pearson's correlation analysis revealed significant correlations between CLABSI prevention practice and the average number of patients with CVC assigned per nurse, knowledge, awareness, resource support, and organizational culture (Table 3).

Individual and organizational factors associated with the practice of CLABSI prevention

The factor that had the greatest association with the practice of CLABSI prevention was organizational culture, followed by awareness and department. These variables explained 41.1% of the variance in CLABSI prevention practice (F = 20.996, $P < .001$). Higher self-reported CLABSI prevention practice was associated with a favorable organizational culture and higher awareness. Emergency room nurses' CLABSI prevention practice was notably inferior as compared to nurses in other departments. The regression analysis satisfied the model's basic assumptions, and there were no multicollinearity issues (Table 4).

DISCUSSION

The main significance of this study is its exploration of both individual and organizational factors that influence nurses' practice of CLABSI prevention across departments in tertiary hospitals that frequently use CVC. Individual factors such as knowledge and awareness related to CVC infection control have been widely explored in previous studies,[7–10] and this study confirmed their importance. Unlike previous studies that rarely investigated resource support and organizational culture as factors impacting practice,[11–14] this study also addressed the significance of organizational factors.

The factor that had the greatest association with CLABSI prevention practice was organizational culture, followed by awareness and departments. In previous studies,[11–14] organizational culture did not apply to CLABSI prevention practices, but the organizational culture was a significant influencing factor on practice or intention in other areas including turnover intention[11] and antimicrobial stewards.[20] The current findings provide fundamental data to improve CLABSI control measures and expand CLABSI prevention practice among clinical nurses.

Another factor that had significant effects on CLABSI prevention practice was working in the emergency department. Emergency room nurses' CLABSI prevention practice was significantly lower than that of nurses in other departments, highlighting that emergency room nurses require education, policies, and training specific to their department environment as well as adequate resource support to improve their organizational culture.

Concerning individual factors, CVC dressing, sampling frequency, and the kind of CVC used did not differ among nurses. Contrastingly, CLABSI prevention practice was positively correlated with the average number of patients with an assigned CVC.

The mean score of organizational culture in this study was 4.19 ± 0.55. These outcomes are similar to the organizational culture conversion score obtained using the same tool in a previous study (5.74 ± 0.83 on a seven-point Likert scale).[21] The statement "Compliance with the hospital's infection control guidelines is a normal task of the department" received the highest score in both this and a previous study;[21] while the statement "When the department finds out that infection control guidelines are not well followed, it freely presents its opinions" received the lowest. The presence or absence of guidelines at the organizational level is significant since it appears that there is a high willingness to follow the rules. Additionally, it is

Table 4
Linear regression analysis predicting nurses' practice of CLABSI prevention (N = 173)

Variable	B	SE	ß	t	*P*	Tolerance limit	VIF
Patient with CVC assigned	0.008	0.012	0.041	0.674	.501	0.948	1.054
Work department (ER = 1)	-0.308	0.087	-0.217	3.542	.001	0.835	1.197
Knowledge	-0.008	0.245	-0.002	0.031	.975	0.815	1.227
Awareness	0.415	0.082	0.328	5.055	<.001	0.686	1.458
Resource support	0.040	0.038	0.071	1.040	.300	0.914	1.094
Organizational culture	0.239	0.048	0.350	4.951	<.001	0.728	1.374

NOTE. R^2 = 0.431, Adjusted R^2 = 0.411, F = 20.996, $P < .001$, Durbin-Waston = 1.996.
CVC, central venous catheter; *ER*, emergency room; *SE*, standard error; *VIF*, variance inflation factor.

important to establish a workplace culture that promotes open discussion and feedback.

While resource support was considered as an organizational factor along with organizational culture, it was not an influencing factor. However, it significantly correlated with infection control practice and organizational culture. A previous study also identified environmental factors and resource support as essential components for hand hygiene.[22] Resource support could vary according to organizational culture and vice versa; therefore, they are interrelated. This suggests that both resource support and organizational culture are vital from an organizational standpoint and that they should be evaluated in tandem.

The level of resource support was investigated targeting various departments that frequently use CVCs. The item with the lowest score in this study was "There is a system that stops insertion if the CVC is not inserted through appropriate procedures." This could be achieved by creating a protocol that facilitates easy inquiry and access to infection control guideline experts, implementing a system to remove improper procedures through the oversight of CVC insertion, exchange, removal, and management, and by appointing dedicated staff for CLABSI prevention.[23]

Concerning knowledge and awareness, the items related to dressing and hand cleanliness scored highly while the ones relating to the placement of the CVC and the timing of the exchange scored poorly. Similar to earlier studies, nurses had firsthand experience and high knowledge of the tasks they typically did, and items with high knowledge correlated with high awareness scores.[8–10] In addition, dressing exchange and sterilization blocking were related to nurses' practice of CLABSI prevention. The findings that raise awareness and promote practice in line with knowledge were confirmed. This suggests that the organizational factors highlighted in this study, along with knowledge and awareness, are necessary before CLABSI prevention practice can be enhanced.

The correct response percentages for the statements "When a CVC is inserted in an emergency, it should be replaced within 48 h at the latest" (23.7%) and "To prevent infection, even if no complications have occurred, the CVC should be periodically exchanged" (29.5%) were the lowest in terms of knowledge. This outcome is comparable to Kim's research findings.[7] As the actual CVC insertion, removal, and exchange procedures are performed by physicians, nurses' knowledge and awareness are lower in these aspects. This underlines the need for more nuanced on-the-job training related to CVC management. Specifically, education should be categorized into maintenance, management, insertion, exchange, and removal.[23] Systems should be implemented in which doctors and nurses can receive training together or share educational content through a designated platform. While doctors are responsible for inserting and removing the CVC, nurses, who maintain and manage CVCs, should be encouraged to offer opinions and recommendations proactively. An environment should be created in which nurses' opinions are actively considered, fostering collaboration rather than a hierarchy among medical staff.

The study had some limitations. Most participants were recruited from ICUs, and only a small number were from emergency rooms in which significant differences in practice scores were observed. Further, the focus on 2 tertiary hospitals in South Korea limits the generalizability of the findings, suggesting the need to recruit participants from different types of hospitals across multiple regions in future research. As the survey was self-reported, there may be a lack of objectivity, which should be addressed in future research through direct observations. In particular, practice was self-reported without direct visualization of nurses' actual practice, and organizational evaluation (resource support and organizational culture) was self-reported without external assessments of organizational structure. Finally, caution is required while interpreting the results owing to the low reliability of the tools used to assess knowledge and awareness.

CONCLUSIONS

The factor that had the greatest association with practice of CLABSI prevention was organizational culture, followed by awareness and department. At the individual level, it is important to enhance the practice of CLABSI prevention in emergency room nurses, in which infection control is especially challenging owing to urgent and hectic situations. Moreover, based on the finding that higher knowledge is linked to higher awareness, it is necessary to foster knowledge through continuous education. At the organizational level, improvements in the nursing care environment are necessary to promote nurses competencies while fostering a positive organizational culture for infection control.

Acknowledgments

None.

APPENDIX

Variables (possible range)	Mean ± SD
Knowledge (0%-100%)	80.2 ± 0.1
To prevent infection, even if no complications have occurred, the central venous catheter should be periodically changed.	29.5 ± 0.5
The central venous catheter should use as many ports as possible for patient care.	85.0 ± 0.4
When a central venous catheter is inserted in an emergency, it should be replaced within 48 h at the latest.	23.7 ± 0.4
After the skin disinfectant dries completely, the central venous catheter must be inserted.	96.0 ± 0.2
If the dressing at the insertion site is wet, loose, or contaminated, it should be replaced.	99.4 ± 0.9
If infection is suspected, central venous catheters without subcutaneous tunnels should be replaced using guide wires.	66.5 ± 0.5
Choose the best insertion site to minimize infections and noninfectious complications based on individual patient characteristics.	90.2 ± 0.3
When inserting a central venous catheter, the maximum barrier precaution should be implemented using a cap, mask, sterile gown, sterile gloves, and sterile sheath covering the whole body.	94.2 ± 0.2
Unless contraindicated, the skin should be disinfected with 2% chlorhexidine-containing alcohol before insertion of the central venous catheter and when changing the dressing.	84.4 ± 0.4
Hand hygiene should be ensured before and after touching the central vein insertion area, before and after insertion, and before dressing.	100.0 ± 0.0
If a central venous catheter is not required, it should be removed immediately.	97.1 ± 0.2
In adults, the central venous catheter transparent dressing should be replaced within 7 days.	94.2 ± 0.2
Evaluate the need to maintain the central venous catheter every day.	97.7 ± 0.2
Clean gloves should be worn when inserting a central venous catheter.	49.1 ± 0.5
Injection ports, catheter hubs, or needleless injection connectors connected to blood vessels should be thoroughly disinfected before and after use with alcohol or alcohol-containing chlorhexidine or povidone disinfectants for 3 to 15 s and dried sufficiently before drug injection.	96.0 ± 0.2
Awareness (1-5)	4.77 ± 0.30

To prevent infection in the central venous catheter without subcutaneous tunnels, the subclavian vein should be chosen over the femoral vein and jugular vein.	4.50 ± 0.66
Hand hygiene should be ensured before and after touching the central vein insertion area, before and after insertion, and before dressing.	4.97 ± 0.17
When inserting a central venous catheter, the maximum barrier precaution should be implemented using a cap, mask, sterile gown, sterile gloves, and sterile sheath covering the whole body.	4.92 ± 0.44
Unless contraindicated, the skin should be disinfected with 2% chlorhexidine-containing alcohol before insertion of the central venous catheter and when changing the dressing.	4.70 ± 0.69
If a central venous catheter is not required, it should be removed immediately.	4.77 ± 0.53
Resource support (1-5)	4.48 ± 0.68
The hospital provides sufficient time and place for training the staff on the central venous catheter infection control guidelines.	3.93 ± 1.16
The hospital educates employees on how to insert and maintain a central venous catheter and how to properly manage infection.	4.07 ± 1.07
The hospital trains the staff if there is a change in the central venous catheter insertion procedure, maintenance method, or equipment.	4.10 ± 1.08
The hospital conducts activities to increase employees' compliance with central venous catheter infection control.	4.05 ± 1.07
Items necessary to comply with the central venous infection control guidelines can be easily used anytime, anywhere (eg, catheter selection with various ports and types of lumen as required/2% chlorhexidine with alcohol/MBP set upon insertion)	4.52 ± 0.74
You can contact an expert at any time for central venous infection control guidelines.	3.95 ± 1.21
The head nurse does not hesitate to praise nurses when they have complied well with the infection control practice.	4.27 ± 0.88
There is a designated employee who manages central vein insertion and maintenance.	3.35 ± 1.46
There are guidelines for central venous catheters.	4.18 ± 1.04
There is a bundle checklist for central venous catheter insertion.	4.29 ± 1.06
There is a system that stops insertion if the central venous catheter is not inserted through appropriate procedures.	3.30 ± 1.39
Organizational culture (1-5)	4.19 ± 0.55
The staff in the department helps me comply with the infection control guidelines.	4.60 ± 0.62
Compliance with the hospital's infection control guidelines is a normal task of the department.	4.86 ± 0.38
The head nurse does not praise when the nurse complies with the infection control guidelines well.	4.27 ± 0.98
My immediate supervisor (the head nurse or responsible nurse) wants to get the job done quickly, even if they skip the infection control guidelines when they have a heavy workload (reverse-scored)	2.55 ± 1.62
When the department discovers that infection control guidelines are not well followed, it freely presents its opinions.	3.94 ± 1.11
When infection control guidelines are not repeatedly followed, the department head takes strong measures.	4.18 ± 0.96
Employees actively work to prevent medical-related infections.	4.54 ± 0.71
Effectiveness is measured when changes are attempted to reduce the incidence of medical-related infections.	4.26 ± 0.93
Evaluation is conducted periodically on whether the department complies with the infection control guidelines.	4.46 ± 0.73
Evaluation results regarding compliance with infection control guidelines are always fed back to me.	4.31 ± 0.93
Practice of CLABSI prevention (1-5)	4.64 ± 0.38
When inserting, disinfecting, and manipulating the central venous catheter, is performed aseptically.	4.83 ± 0.43
If the dressing is wet, loose, or contaminated, replace the dressing at the insertion site.	4.91 ± 0.31
In adults, inform your doctor not to insert the central venous catheter into the femoral vein as much as possible.	3.91 ± 1.22
Dress the insertion area with sterile gauze if the patient sweats a lot, bleeds in the insertion area, or leaks fluid.	4.81 ± 0.51
The gauze dressing is replaced every 2 days.	4.85 ± 0.51
The transparent film used in dressing is replaced every 7 days.	4.88 ± 0.46
When inserting a central venous catheter, use a cap, mask, sterilization gown, sterilization gloves, and a sterilization shield to cover the whole body to prepare for maximum barrier precaution.	4.86 ± 0.51
Tell your doctor to remove the central venous catheter immediately if it is not necessary.	4.47 ± 0.81
If not contraindicated, prepare to disinfect the skin with more than 2% chlorhexidine containing alcohol before insertion of the central venous catheter and when changing the dressing.	4.72 ± 0.66
The central venous catheter is prepared to be used with the minimum port and lumen required for patient treatment.	4.37 ± 0.89
Advise your doctor to insert a central venous catheter after the skin disinfectant is completely dry.	4.34 ± 0.10
Before and after use, injection ports, catheter hubs, and needleless injection connectors connected to blood vessels are thoroughly disinfected with alcohol or alcohol-containing chlorhexidine and povidone disinfectants for 3 to 15 s and dry enough before drug injection.	4.73 ± 0.56

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