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Evidence-Based Knowledge and Attitudes of Intensive Care Nurses Regarding the Prevention of Central Venous Catheter Infections: A Descriptive Correlational Study*

Yoğun Bakım Hemşirelerinin Santral Venöz Kateter Enfeksiyonlarının Önlenmesine Yönelik Kanıta Dayalı Bilgi ve Tutumları: Tanımlayıcı ve İlişkisel Bir Çalışma

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Abstract

Aim: This study aimed to examine the relationship between intensive care unit nurses' knowledge of evidence-based practices for preventing central venous catheter (CVC) associated infections and their attitudes toward evidence-based nursing.

Method: This descriptive correlational study was conducted between October 2022-October 2023 with 164 nurses at a university hospital in Istanbul and a city hospital in Ankara. In the study; "The Descriptive Information Form", "Evidence-Based Nursing Attitude Scale" and "Intensive Care Nurses' Evidence-Based Guideline Knowledge Assessment Test in Preventing CVC-related Infections" were used.

Results: The mean knowledge score for prevention of central venous catheter infection was 5.37 (SD=1.68); moderate level) and the mean evidence-based attitude score was 46.76 (SD=4.97); good level). When demographic characteristics were compared with knowledge and attitude levels, it was found that nurses who were 31-40 years old, female, married, had 10 years or more of professional experience, had 4-6 years of intensive care experience, worked in a university hospital, and worked in the day shift had higher levels of knowledge about central venous catheter-related infections. In addition, it was found that the evidence-based nursing attitude scores of female nurses, nurses aged 31-40 years, nurses with postgraduate education, nurses with ten years or more of intensive care experience, and day shift workers were statistically significantly higher A low level positive correlation was found between knowledge and attitudes.

Conclusion: Increasing evidence-based training and encouraging nurses to apply this knowledge in clinical practice are essential to improve infection prevention in intensive care units. These measures are expected to enhance patient care quality and reduce CVC-associated infections.

Keywords: Central venous catheter, catheter-related infections, evidence-based nursing, intensive care units.

Öz

Amaç: Bu çalışma, yoğun bakım ünitesi hemşirelerinin santral venöz kateter ilişkili enfeksiyonları önlemeye yönelik kanıta dayalı uygulamalar hakkındaki bilgileri ile kanıta dayalı hemşireliğe yönelik tutumları arasındaki ilişkiyi incelemeyi amaçlamıştır.

Yöntem: Ekim 2022-Ekim 2023 tarihleri arasında İstanbul'daki bir üniversite hastanesi ve Ankara'daki bir şehir hastanesinde toplam 164 hemşirenin katılımıyla gerçekleştirilen bu tanımlayıcı ve ilişki belirleyici çalışmada, "Tanıtıcı Bilgi Formu, Kanıta Dayalı Hemşirelik Tutumları Ölçeği ve Yoğun Bakım Hemşirelerinin Santral Venöz Kateter İlişkili Enfeksiyonları Önleme Konusunda Kanıta Dayalı Rehber Bilgi Değerlendirme Testi" kullanılmıştır.

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Bulgular: Çalışmada, santral venöz kateter enfeksiyonunu önlemeye yönelik ortalama bilgi puanı 5,37 (SS=1,68); orta düzey) ve ortalama kanıta dayalı tutum puanı 46,76 (SS=4,97); iyi düzey) bulunmuştur. Katılımcıların tanıtıcı özellikler ile bilgi ve tutum düzeyleri karşılaştırıldığında; 31-40 yaş arası, kadın, evli, 10 yıl ve üzeri mesleki deneyime sahip, 4-6 yıl yoğun bakım deneyimi olan, üniversite hastanesinde çalışan ve gündüz vardiyasında çalışan hemşirelerin santral venöz kateter ilişkili enfeksiyonlara yönelik bilgi düzeylerinin daha yüksek olduğu saptanmıştır. Ayrıca kadın hemşirelerin, 31-40 yaş arası hemşirelerin, lisansüstü eğitim almış hemşirelerin, on yıl ve üzeri yoğun bakım deneyimi olan hemşirelerin ve gündüz vardiyasında çalışanların kanıta dayalı hemşirelik tutum puanlarının istatistiksel olarak anlamlı düzeyde daha yüksek olduğu bulunmuştur. Bilgi ve tutum arasında düşük düzeyde olumlu ilişki saptanmıştır.

Sonuç: Kanıta dayalı eğitimlerin artırılması ve hemşirelerin bu bilgileri klinik uygulamalara yansıtmasının desteklenmesi, yoğun bakım ünitelerinde enfeksiyon önlemenin iyileştirilmesi için önemlidir. Bu önlemler, hasta bakım kalitesini artırarak santral venöz katater ilişkili enfeksiyonların azaltılmasına katkı sağlayacaktır.

Anahtar Sözcükler: Santral venöz kateterler, kateter ilişkili enfeksiyonlar, kanıta dayalı hemşirelik, yoğun bakım üniteleri.

Introduction

Central venous catheters (CVCs) are invasive devices frequently used in intensive care units (Lin et al., 2022). These catheters are indicated for total parenteral nutrition, blood and fluid resuscitation, and drug administration (Howthan et al., 2020; Su et al., 2021).

Central venous catheters, which are frequently used for various clinical indications, have both advantages and disadvantages. Various mechanical, infectious, and thrombotic complications may occur during the use of CVCs. (Kıray et al., 2019). Complications such as septicemia, colonisation, phlebitis, leakage of intravenous fluids or drugs outside the vein, and catheter-related bloodstream infections (CLABSI) may also occur. These complications associated with central venous catheters can significantly affect morbidity and mortality rates in patients (Buetti & Timsit, 2019).

While the insertion of central venous catheters is the responsibility of physicians, nurses are responsible for their maintenance and ongoing management (Arvaniti et al., 2017). Proper insertion of CVCs using appropriate techniques, together with the continuous implementation of evidence-based care practices, is critical for preventing complications and improving patient comfort. Evidence-based care bundles are effective in providing high-quality care while reducing infection rates, morbidity, and healthcare costs (Ista et al., 2016).

Central venous catheter–associated infections are the leading healthcare-associated infections and represent one of the most significant threats to patient safety (Özen al., 2020). National and international organizations have prepared guidelines to prevent and control CVC-associated infections. These guidelines include training healthcare workers who insert and maintain catheters, taking maximum sterile barrier precautions during central venous catheter placement, using 0.5% chlorhexidine in alcohol for skin antisepsis, assessing the need for catheters daily, and removing them immediately when no longer needed (O'Grady et al., 2017; Turkish Society for Hospital Infections and Control [TSHIC], 2019).

Evidence-Based Practice (EBP) involves using the best and most current evidence to plan and provide medical care to support patient recovery (Çopur et al., 2015). Evidence-Based Nursing Practice (EBNP) provides quality care based on research, improves the quality of care, standardizes practices, helps decision-making and reduces costs (Karataş Baran et al., 2020). Following the best available evidence in nursing practice is essential for professional development and quality of care.

Method

Aim: This research was conducted to evaluate the relationship between the knowledge levels of nurses working in Intensive Care Unit (ICU) regarding evidence-based practices in preventing CVC-associated infections and their attitudes towards evidence-based nursing.

Research Questions

- How knowledgeable are ICU nurses' about evidence-based practices for the prevention of CVC-associated infections?
- What are the attitudes of ICU nurses' towards EBNAS?

• Is there a relationship between the descriptive characteristics of ICU nurses' and their knowledge of evidence-based guidelines for the prevention of CVC-associated infections and their attitudes towards EBNAS?

Design: This descriptive, cross-sectional, and correlational study was conducted to examine the relationship between intensive care nurses' knowledge regarding the prevention of CVC-associated infections and their attitudes toward evidence-based practices.

Sample and Setting: Data were collected between October 2022 and October 2023 in the intensive care units of a university hospital in Istanbul and a City Hospital in Ankara. The study was conducted in nine intensive care units, including Emergency Surgery, Neurosurgery, Reanimation, Cardiovascular Surgery, Neonatal, Pediatric, Neurology, Orthopedics, and Coronary Intensive Care Unit. Intensive care units ranged from level 1 to level 3. The total ICU bed capacity of both hospitals was 151. Although the patient-to-nurse ratio in the unit varies from day to day, it is 2:1 or 3:1 during working hours and across shifts. Orientation and in-service training for nurses at the university hospital include content related to CVC. Likewise, training related to CVC is provided within the institution departments. The population of the study consisted of 259 ICU nurses. The study sample was selected using a sampling method for a known population. The formula n = N . t2 . p . q/ d2 . (N-1)+t2.p.q formula was used. The sample size was determined to be 155 nurses, and the study was completed with 164 nurses. Nurses who had been working in the ICU for at least 2 months and who volunteered were included in the study. Nurses undergoing orientation or working in the ICU in a daily-support capacity were not included in the study.

Data Collection Tools

The Descriptive Information Form: Its demographic characteristics of the nurses (age, gender, marital status, educational level, etc.) and professional characteristics (professional experience, ICU experience, department, CVC care training, etc.) (Temiz et al., 2022; Aslan & Gürdap, 2021; Chi et al., 2020).

Evidence-Based Nursing Attitudes Scale (EBNAS): The scale developed by Ruzafa-Martínez et al. in 2011. The scale was adapted into Turkish by Ayhan et al. (2015). The EBNAS measures intensive care nurses' behaviors regarding evidence-based practice. A 5-point Likert scale was used. There are eight positive and seven negative items (3, 4, 6, 8, 10, 12, and 15), making a total of 15 items on the scale. The scale has a Beliefs and Expectations Subscale (items 1, 2, 7, 9, 11, 13, 14), an Intention to Implement Subscale (items 3, 5, 6, 12), and an Emotions Related to Nursing Subscale (items 4, 8, 10, 15). Scores range from 15 to 75 points on the scale. Higher scores on the scale indicate a more favorable attitude toward evidence-based nursing. Cronbach's alpha for the scale is 0.85 (Ayhan et. al., 2015). Cronbach's alpha for the study was 0.91.

Evidence-Based Guideline Knowledge Assessment Test of Critical Care Nurses in Preventing Central Venous Catheter Related Infections: It was developed by Labeau et al. in 2008. The test was adapted into Turkish by Şanlı ve Sarıkaya (2020). In line with current evidence-based information, 10 nursing interventions related to central venous catheters and four multiple-choice options for each intervention were prepared. Each correct answer in the knowledge test was evaluated as "1 point" and each wrong answer as "0 point". The lowest score in this test was 0 and the highest score was 10. In this study, the KR-20 reliability coefficient was calculated as 0.829, indicating a good level of internal consistency (Bademci, 2011).

Data Collection Process: Institutional approvals were obtained from both hospitals where the study was conducted. The head nurse or charge nurse of each ICU was consulted, and the purpose of the study was explained to them. Participation was entirely voluntary, and no identifying information was collected from the sample. The questionnaires were collected by the researchers within 5–10 days of distribution. Participants provided their informed consent, either verbally or in writing.

Data Analysis: Statistical analyses were performed using IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA). Categorical variables were presented as frequencies and percentages (%), while continuous variables were expressed as means and standard deviations. The normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Since the data did not follow a normal distribution, non-parametric tests were employed. The Mann–Whitney U test was used to compare two groups, and the Kruskal–Wallis test was used to compare three or more groups. When a significant difference was detected with the Kruskal-Wallis test, post hoc analysis using the Mann-Whitney U test was conducted to determine which groups accounted for the difference. To assess relationships between variables, the Spearman rank correlation test was used. In the regression analysis, model assumptions were tested, and when heteroskedasticity was detected, robust standard errors were estimated using the Newey-West estimator. Regression diagnostics confirmed that the error terms were normally distributed (Jarque-Bera test, $p = 0.285$), that there was no autocorrelation (LM test, $p = 0.160$), and that homoskedasticity was maintained (Harvey test, $p = 0.151$). All model assumptions were met. The analysis results were reported with correlation coefficients (r) and significance levels ($p < 0.05$).

Ethical Considerations: Approval for the study was granted by the İstanbul University Social and Human Sciences Research Ethics Committee (approval number: 893373). Additionally, institutional consent was obtained from the hospitals where the research was conducted. Permission to use the scales in the study was obtained from the relevant authors. Participants were given detailed information about the study, and their consent was obtained after an explanation that participation was voluntary. Participants' identity information was kept confidential, and the data were used only for research purposes.

Strengths and Limitations: In this study, the relationship between intensive care nurses' levels of evidence-based knowledge regarding the prevention of CVC-associated infections and their attitudes toward evidence-based nursing practices was examined. Focusing on a high-risk care area and including nurses with different levels of experience in the study provide important guidance for both education and practice.

However, this study has some limitations. One important limitation is the lack of information regarding the content and standardisation of institutional training programs for nurses on CVC care. This variability in training may have contributed to differences in nurses' knowledge levels and thus may have affected the study results. In addition, the study was conducted in only two hospitals, limiting the generalisability of the results to other institutions or geographical regions. Data were collected through self-report questionnaires, which may lead to response bias.

Results

Table 1. Descriptive characteristics (N:164)

Variables		n	%
Gender	Female	124	75.6
	Male	40	24.4
Age/Years	20-30	108	65.9
	31-40	29	17.7
	41-50	27	16.5
mean (SD), min–max	**31.14 (7.76), 23-58**		
Marital status	Married	75	45.7
	Single	89	54.3
Education level	Occupational School	11	6.7
	Associate Degree	6	3.7
	Bachelor's degree	102	62.2
	Postgraduate	45	27.4
Professional experience (year)	0-3	52	31.7
	4-6	45	27.4
	7-9	19	11.6
	≥10	48	29.3
mean (SD), min–max	**8.56 (4.69), 0.5–41**		
Experience in ICU (year)	0-3	72	43.9
	4-6	36	22.0
	7-9	22	13.4
	≥10	34	20.7
mean (SD), min–max	**6.67 (4.40), 0.17–36**		
Hospital type	City Hospital	56	34.1
	University Hospital	108	65.9
Working department/ICU	Surgical	37	22.6
	Internal Medicine	14	8.5
	Cardiovascular Surgery	15	9.1
	Coronary	6	3.7
	Neurology	3	1.8
	Anaesthesia	56	34.1
	Neonatal/Pediatric	16	9.8
	Neurosurgical	6	3.7
	Other	11	6.7

Table 1. Descriptive characteristics (N:164)

Variables		n	%
Working shifts	Day shift	38	23.2
	Rotating shifts	126	76.8
Professional Role	Nurse in Charge	26	15.9
	Clinical Nurse	130	79.3
	Team Leader	4	2.4
	Clinical Education Nurse	2	1.2
	Other	2	1.2
Does your hospital have a protocol/procedure for CVC care?	Yes	125	76.2
	No.	12	7.3
	I don't know	27	16.5
Have you received training in the care of the CVC?	Yes	154	93.9
	No	10	6.1
Education Type			
Orientation training	Yes	76	46.3
	No	88	53.7
In-service training program	Yes	101	61.6
	No	63	38.4
Intensive care certificate program	Yes	61	37.2
	No	103	62.8
Congress/seminar/symposium	Yes	39	23.8
	No	125	76.2
Topics in the nursing education curriculum	Yes	64	39.0
	No	100	61.0
Clinical environment and experience	Yes	94	57.3
	No	70	42.7
Consultation with colleagues (nurse. doctor...)	Yes	63	38.4
	No	101	61.6
Reading published guidelines	Yes	42	25.6
	No	122	74.4

Descriptive characteristics: In this study, 75.6% (n=124) of the nurses were female; the mean age was 31.14±7.76 years; 54.3% (n=89) were single; and 62.2% (n=102) had an undergraduate degree. Among the nurses, 34.1% (n = 56) worked in a city hospital and 65.9% (n = 108) worked in a university hospital. In response to the question “Is there a protocol/procedure for CVC care in your hospital?” 76.2% (n = 125) of participants responded affirmatively. In response to the question “Have you received training on CVC care?”, 93.9% (n=154) of the nurses confirmed that they had received such training (Table 1).

Analysis of nurses' responses to the test evaluating evidence-based guidelines for the prevention of CVC-associated infections found that the practice with the highest number of correct answers was: "It is recommended to change the infusion sets used to administer lipid emulsions via CVC within the following period," with a correct-response rate of 83.5% (n = 137). On the other hand, the practice with the most incorrect responses was the statement "It is recommended to change the infusion sets that are not given lipid emulsions or blood products via CVC within the following period," which had an incorrect-response rate of 87.8% (n=144). The mean score of intensive care nurses on the knowledge test for preventing CVC-related infections was 5.37 (SD = 1.68) (Table 2).

Table 2. Analysis of nurses' responses to the test of evaluation of evidence-based guidelines for the prevention of CVC-associated infections (N:164)

	Evaluation test score of evidence-based guideline knowledge of ICU Nurses' in preventing CVC-associated infections	Correct Answers		Wrong Answers	
		n	%	n	%
1	Regular replacement of central venous catheters (CVC) is recommended.	111	67.7	53	32.3
2	It is recommended to replace CVCs over the guidewire.	114	69.5	50	30.5
3	It is recommended that pressure transducers and sets be replaced regularly.	98	59.8	66	40.2
4	In settings with a high incidence of catheter-related infections, the use of an antimicrobial/ antiseptic coated CVC is recommended	96	58.5	68	41.5
5	It is recommended to replace the transparent cover for the catheter insertion site dressing	98	59.8	66	40.2
6	It is recommended to use this/s for catheter insertion site dressing.	60	36.6	104	63.4
7	It is recommended to disinfect the catheter insertion site with	95	57.9	69	42.1
8	It is recommended to apply antibiotic ointment to the CVC insertion site.	51	31.1	113	68.9
9	It is recommended that infusion sets given lipid emulsions via CVC be changed within the following period.	137	83.5	27	16.5
10	It is recommended that infusion sets that do not receive lipid emulsions or blood products via CVC should be replaced within this period.	20	12.2	144	87.8
		mean (SD)		min-max	
	Total	5.37 (1.68)		1-10	
	KR 20= 0.829				

Descriptive statistics of the EBNAS and its subdimensions indicate that the mean score of the Beliefs and Expectations sub-dimension was 30.62 (SD = 5.26, range = 7–35; α=0.799). The Intention to Implement sub-dimension had a mean of 10.03 (SD = 1.95, range = 6–16; α = 0.840). For the Emotions Related to Nursing sub-dimension, the mean was 6.10 (SD = 2.51, range = 4–18; α = 0.795). The total EBNAS score was 46.76 (SD = 4.97, range = 21–58), indicating excellent reliability (α = 0.910) (Table 3).

Table 3. Descriptive statistics of the Evidence-Based Nursing Attitudes Scale (EBNAS) and its sub-dimensions (N:164)

EBNAS	mean (SD)	min-max	Cronbach's Alpha
Beliefs and Expectations	30.62 (5.26)	7-35	0.799
Intention to Implement	10.03 (1.95)	6-16	0.840
Emotions Related to Nursing	6.10 (2.51)	4-18	0.795
Total	46.76 (4.97)	21-58	0.910

Mean scores of the EBG Test for Prevention of CVC infection and of the EBNAS according to nurses' descriptive characteristics are shown in Table 4. Analysis of the nurses' demographic data showed that nurses who were 31–40 years of age (p=0.009), female (p=0.048), married (p=0.016), had 10 or more years of work experience (p=0.008), had 4–6 years of ICU experience (p=0.015), worked in a university hospital (p=0.020), and worked daytime shifts (p=0.001) had higher levels of knowledge regarding prevention of CVC infections.

Female nurses (p = 0.015), nurses aged between 31 and 40 years (p = 0.003), nurses with postgraduate education (p = 0.001), nurses with 10 or more years of ICU experience (p = 0.011), and nurses with daytime working hours (p = 0.027) had a higher total score on the EBNAS.

Table 4. Mean scores of nurses according to their descriptive characteristics on the test for evaluating their knowledge of evidence-based guidelines in preventing CVC- associated infections and on the Evidence-Based Nursing Attitudes Scale (N:164)

		Beliefs and Expectations		Intention to Implement		Emotions Related to Nursing		EBNAS Total		EBG Test for CVC Infection Prevention	
Variables	**n**	**Mean (SD)**		**Mean (SD)**		**Mean (SD)**		**Mean (SD)**		**Variables**	
Gender											
Female	124	30.97 (511)		**16.84 (2.48)**		18.02 (2.48)		**65.82 (8.96)**		**5.53 (1.67)**	
Male	40	29.55 (563)		15.45 (2.45)		17.53 (2.62)		62.53 (8.38)		4.85 (1.61)	
MWU/p		**2080.5**	**0.120**	**1722.5**	**0.003****	**2211.0**	**0.282**	**1845.5**	**0.015***	**1972.0**	**0.048***
Age											
20-30[1]	108	29.86 (5.72)		16.20 (2.60)		17.38 (2.77)		63.44 (9.60)		5.10 (1.57)	
31-40[2]	29	**32.79 (3.42)**		**17.72 (2.06)**		**18.90 (1.63)**		**69.41 (6.29)**		**6.13 (1.78)**	
41-50[3]	27	31.33 (4.23)		16.37 (2.42)		18.89 (1.42)		66.59 (6.44)		5.59 (1.75)	
KW/p		**8.79**	**0.012***	**8.301**	**0.016***	**11.853**	**0.003 ****	**11.613**	**0.003 ****	**9.349**	**0.009****
Post Hoc:		**2>1, 3>1**		**2>1, 2>3**		**2>1, 3>1**		**2>1, 2>3**		**2>1, 2>3**	
Marital status											
Married	75	30.68 (5.04)		16.64 (2.51)		17.91 (2.29)		65.23 (8.19)		**5.71 (1.73)**	
Single	89	30.57 (5.46)		16.38 (2.50)		17.89 (2.70)		64.84 (9.52)		5.08 (1.59)	
MWU/p		3323.5	0.962	3143.0	0.517	**2622.0**	**2622.0**	3302.5	0.908	**2622.0**	**0.016 ***
Education level											
Occupational School[1]	11	28.27 (7.36)		15.82 (2.31)		17.00 (2.14)		61.09 (8.79)		5.00 (1.48)	
Associate Degree[2]	6	28.00 (5.51)		15.50 (3.27)		17.17 (2.22)		60.67 (10.25)		5.50 (1.51)	
Bachelor's degree[3]	102	30.18 (5.42)		16.10 (2.49)		17.68 (2.74)		63.95 (9.41)		5.19 (1.72)	
Postgraduate[4]	45	**32.56 (3.55)**		**17.71 (2.24)**		**18.71 (1.86)**		**68.98 (6.02)**		5.84 (1.60)	
KW/p		**13.335**	**0.004****	**14.733**	**0.002****	**9.184**	**0.027***	**16.210**	**0.001****	4.543	0.208
Post Hoc:		**4>1, 4>2**		**4>1, 4>2**		**4>1, 4>2, 4>3**		**4>1, 4>2, 4>3**			
Professional working time (year)											
0-3[1]	52	29.17 (6.99)		15.85 (2.71)		17.12 (2.95)		62.13 (11.05)		4.77 (1.33)	
4-6[2]	45	30.67 (4.08)		16.56 (2.28)		17.76 (2.32)		64.98 (7.24)		5.64 (1.79)	
7-9[3]	19	31.26 (4.62)		16.95 (2.85)		17.53 (3.04)		65.74 (9.84)		5.32 (1.97)	
≥10[4]	48	31.90 (3.86)		16.98 (2.35)		**19.02 (1.36)**		**67.90 (6.23)**		**5.77 (1.65)**	
KW/p		4.515	0.211	4.821	0.185	**13.758**	**0.003****	**8.319**	**0.040***	**11.748**	**0.008****
Post Hoc:						**4>1, 4>2, 4>3**		**4>1, 4>2**		**4>1**	
Hospital type											
City Hospital	56	30.75 (6.88)		16.32 (2.91)		17.91 (2.99)		64.98 (11.11)		5.02 (1.71)	
University Hospital	108	30.56 (4.21)		16.59 (2.33)		17.89 (2.24)		65.04 (7.58)		**5.55 (1.64)**	
MWU/p		2482.5	0.056	2867.5	0.584	2781.5	0.380	2731.0	0.309	**2362.5**	**0.020***
Working shifts											
Day shift	38	32.44 (3.56)		17.55 (1.88)		18.55 (1.73)		68.55 (5.83)		6.26 (1.76)	
Rotating shifts	126	30.07 (5.56)		16.18 (2.63)		17.69 (2.68)		63.95 (9.41)		5.09 (1.56)	
MWU/p		**1.775**	**0.014***	**1.665**	**0.004****	2.068	0.186	**1.718**	**0.008****	**1.483**	**<0.001**

EBNAS: Evidence-Based Nursing Attitudes Scale; EBG Test for CVC Infection Prevention: Evaluation Test Score of evidence-based guideline knowledge of ICU Nurses' in preventing CVC-related infections; KW: Kruskal-Wallis test; MWU: Mann-whitney U testi.
*p<0.05; **p<0.01

Table 5. Analysis of the relationship between icu nurses' evaluation score of evidence- based guideline knowledge in preventing CVC-associated infections and the Evidence- Based Nursing Attitudes Scale (N=164)

		Beliefs and expectations	Intention to Implement	Emotions Related to Nursing	Total
Evaluation test of evidence- based guideline knowledge of ICU Nurses' in preventing CVC-related infections	r	**0.129**	0.114	0.059	**0.126**
	p	**0.032***	0.095	0.416	**0.035***

r: Spearman Correlation test
*p<0.05

Correlation analysis: In evaluating ICU nurses' knowledge of evidence-based guidelines for the prevention of CVC-associated infections, a low positive correlation was observed between knowledge and the "Beliefs and Expectations" sub-dimension (r = 0.129, p = 0.032), whereas no statistically significant associations were identified with the "Intention to Implement" and "Emotions Related to Nursing" sub-dimensions (Table 5). In this study, the interpretation of effect sizes was based on Cohen's (1988) classification. According to Cohen's classification, a correlation coefficient between 0.10 and 0.29 indicates a small effect size (weak relationship), between 0.30 and 0.49 indicates a medium effect size (moderate relationship), and above 0.50 indicates a large effect size (strong relationship).

Tablo 6. Regression prediction results for the effect of intensive care nurses' evidence-based practice attitudes on the prevention of CVC-associated infections (N=164)

Independent variables	Not standardized		Standardized coefficient	t	p
	β	Std. Error	β		
Fixed	3.743	1.006	-	3.722	**<0.001**
Beliefs and expectations	0.097	0.032	0.148	3.031	**0.041***
Intention to Implement	0.096	0.070	0.144	1.357	0.177
Emotions Related to Nursing	0.078	0.075	0.117	1.048	0.296

R^2 = 0.067 $F_{calculatiion}$ =1.613 $F_{significance}$ =0.048 Harvey test (p) = 0.151 LM test (p)= 0.160 Jarque-Bera (p)=0.285

Dependent variable: Score for Evaluation of Evidence-Based Guideline Information in Preventing CVC- Associated Infections.
*p<0.05

Regression analysis: In the regression analysis in Table 6, the sub-dimensions of "Intention to Implement" and "Emotions Related to Nursing" were not significantly associated with the knowledge test assessment scores in preventing CVC-related infections (p=0.177, p=0.296). On the contrary, the "Beliefs and Expectations" sub-dimension was significantly associated with the score on the evaluation of evidence-based guideline knowledge in the prevention of CVC- associated infections (p=0.41). When "Beliefs and Expectations" increased by 1 br., evaluation of evidence-based guideline information in preventing CVC-associated infections would increase by 0.148 br. (β=0.148; p=0.41) For these estimation results, it has been determined that the error terms are normally distributed (Jarque-Bera test, p = 0.285), that there is no autocorrelation (LM test, p = 0.160), and that the assumption of homoskedasticity is satisfied (Harvey test, p = 0.151) (Table 6).

Discussion

In this study, the relationship between intensive care nurses' level of evidence-based knowledge for preventing CVC-associated infections and their attitudes toward evidence-based nursing practices was examined. The findings provide important data on the relationship between nurses' knowledge levels and attitudes.

The nurses' evidence-based knowledge score for preventing infections associated with CVCs was 5.37 (SD = 1.68) out of 10 (Table 2). Based on this finding, the nurses' knowledge was moderate. When the evidence-based guideline knowledge scores of the nurses participating in the study in preventing CVC-associated infections were examined; the question "It is recommended to change the infusion sets that are given lipid emulsions via CVC within the following period of time" was the question that nurses (83.5%; n=137) answered most correctly (Table 2) and was found to be consistent with the studies in the literature (Aslan & Gürdap, 2021; Köse et al., 2023). It was determined that the correct answer was "every 96 hours"; nurses gave the wrong answer to the question "It is recommended to change the infusion sets that are not given lipid emulsions or blood products via CVC within the following period". In a similar study, only 4% (n = 8) of the nurses answered this question correctly (Aydoğdu & Akgün, 2020). Chi et al. (2020) found that 10.6% of the nurses reported 96

hours. Susam and Arslan (2020) found that nurses' knowledge of the timing for changing sets that are not used for blood or blood products is low, whereas their knowledge of the timing for changing sets when lipid solutions are administered through the CVC is high.

The results of our study showed that nurses' EBNAS scores were at an intermediate level (mean = 46.76, SD = 4.97; Table 3). When the studies conducted were examined, it was found that there are studies that determined that the average score of the EBN was at a low level (Aslan & Gürdap, 2021; Dikmen et al., 2018), as well as studies that reported that the mean score of the EBNAS was at a medium level (Daştan & Hintistan, 2018; Dirgar et al., 2023; Karakoç Kumsar et al., 2020; Köse et al., 2023; Yanmış & Özcan, 2022; Yılmaz et al., 2019).

It was found that nurses were willing to use evidence-based practices to prevent infections associated with CVC, but they did not sufficiently apply them in care. Similar results were reported by Alqahtani et al. (2019). According to this study, although nurses (N=227) have positive attitudes, wishes, and beliefs toward evidence-based practices, they are not active in translating these into practice. A similar study found that although nurses had a positive attitude towards evidence-based practices and wanted to implement the best evidence, they could not implement them due to a lack of support and resources (Duncombe, 2018). Many studies have also found that a lack of institutional support is the biggest barrier to evidence-based practices (Berthelsen & Hølge-Hazelton, 2021; Ibikunle et al., 2021; Yoo et al., 2019).

Studies show that increases in nurses' education level positively affect their knowledge scores regarding the prevention of central venous catheter-related infections (Chi et al., 2020; Türkkan et al., 2019). This study found no significant relationship between nurses' levels of education and their knowledge of CVC infection prevention. However, nurses with postgraduate degrees scored higher on all subscales of evidence-based attitudes (Table 4). These findings suggest that nurses' attitudes and beliefs toward evidence-based practice may strengthen with increasing education. The literature reveals mixed results, influenced by factors such as sample characteristics, work environment, and individual differences. For example, Alzoubi et al. (2025) reported that nurses with bachelor's degrees had higher attitude scores, whereas Alqalah (2024) found that nurses with master's degrees scored higher in knowledge, attitudes, and adherence to evidence-based practice. Overall, it can be concluded that postgraduate-educated nurses tend to be more knowledgeable, motivated, and open to adopting and integrating evidence-based practices into clinical care.

This study found that nurses aged 31–40 years had higher scores for knowledge and for evidence-based attitudes regarding the prevention of central venous catheter-associated infections (Table 4). This difference may be attributed to the accumulation of professional knowledge and experience with increasing age. However, Šabanė et al. (2022) reported opposite findings in their study of intensive care nurses, reporting that younger nurses (22-29 years) demonstrated a greater willingness to seek information and a higher level of engagement in evidence-based practices. They also noted that this age group placed greater importance on evidence-based nursing. Similarly, Alzoubi et al. (2025) found more positive attitudes among nurses under 30, while Alqalah (2024) reported that nurses over 40 exhibited higher levels of knowledge, attitudes, and adherence to evidence-based practices.

This study found that nurses' average EBNAS and CVC knowledge scores also increased with increasing years of professional experience (Table 4). A study by Palioğlu and İpekçoban (2021) similarly found a significant positive relationship between nurses' length of service and their knowledge level. Additionally, Özen et al. (2020) found that knowledge levels regarding CVC-associated infection prevention increased with years of employment. These results support findings in the literature that experience increases knowledge levels (Alqalah, 2024; Chi et al., 2020; He et al., 2025). The study found that nurses who had worked in the ICU for 10 years or more had significantly higher knowledge scores than those with less ICU experience. This result suggests that longer exposure to critical care environments may contribute positively to nurses' knowledge of CVC-associated infection prevention.

This study found that day-shift nurses had higher knowledge scores regarding the prevention of CVC-associated infections (Table 4). This finding supports the observation that day-shift nurses typically possess greater seniority and clinical experience than night-shift nurses. In fact, experienced nurses' greater participation in in-service training, greater involvement in clinical procedures, and greater exposure to practical applications may have contributed to their higher levels of knowledge. However, more comprehensive analyses are needed to better understand this relationship, especially those that take into account potential influencing factors such as access to in-service training, experience with clinical procedures, and patient workload.

Of the nurses, 34.1% (n=56) worked in a city hospital and 65.9% (n=108) worked in a university hospital. Regarding the general dimension of the test evaluating intensive care nurses' knowledge of evidence-based guidelines for preventing CVC-associated infections, scores were higher among nurses working at the university institution (Table 4). Similar to our findings, a study conducted in China, which evaluated the level of knowledge regarding evidence-based guidelines for the prevention of CVC-related bloodstream infections, revealed that intensive care nurses working individuals in higher-level hospitals had greater general knowledge regarding these guidelines (Chi et al., 2020). It may be attributable to greater institutional support for nurses in university hospitals and to regular in-service training programs.

In our study, a low positive correlation was found for the overall score ($r = 0.126$, $p = 0.035$; Table 5), which aligns with the findings of Gezginci Akpınar et al. (2025), who reported a weak positive correlation between knowledge and attitude scores regarding the prevention of catheter-related bloodstream infections and evidence-based nursing attitudes ($r = 0.334$, $p < 0.001$). According to the regression analysis, the "beliefs and expectations" dimension significantly predicted nurses' knowledge level regarding the prevention of CVC-related infections, while the "intention to implement" and "emotions related to nursing" dimensions showed no significant association (Table 6). This finding suggests that knowledge level is more closely related to cognitive and motivational factors and that individual beliefs may play a key role in knowledge acquisition.

Conclusion and Recommendations

This study revealed that intensive care unit nurses possess a moderate level of knowledge regarding the prevention of central venous catheter (CVC)-associated infections and generally hold positive attitudes toward evidence-based nursing practices. A low yet statistically significant positive correlation between nurses' knowledge levels and their attitudes was identified, indicating that enhancing knowledge could foster more favorable attitudes toward evidence-based care. Furthermore, factors such as education level, years of ICU experience, and shift type were significantly associated with variations in knowledge scores.

Based on these findings, it is essential to implement regular in-service training programs aimed at improving nurses' knowledge of evidence-based guidelines, particularly in infection prevention within intensive care settings. Moreover, integrating evidence-based practice more comprehensively into nursing education curricula could strengthen both theoretical understanding and clinical attitudes. Future research should further explore these relationships through longitudinal or interventional study designs and consider incorporating objective measures of clinical practice to validate self-reported data. By addressing these areas, the quality of patient care related to CVC infection prevention can be improved.

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