Prevention of Central Line-Associated Bloodstream Infections: Knowledge, Attitudes and Behaviors of Nurses in the Kingdom of Saudi Arabia

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Abstract

Objectives: This study aims to assess the level of knowledge, behavior, and attitude of nurses in Adult Intensive Care and Hemodialysis Units in a military hospital in the Kingdom of Saudi Arabia regarding Central Line Associated Blood Stream Infections prevention.

Methods: This study adopted a quantitative descriptive cross-sectional and comparative design. Data collection was performed in July 2018 with a response rate of 81%. A total of 121 nurses participated using a self-administered questionnaire consisting of 20 items.

Results: The results showed that participants had an adequate level of knowledge and behavior regarding the evidence-based guidelines of Central Line Associated Blood Stream Infections prevention. The participants' level of knowledge was significantly associated with their years of experience. The participants had highly positive attitudes regarding the utilization of CLABSI prevention evidence-based guidelines. Participants from critical care unit had higher level of knowledge and behavior regarding the evidence-based guidelines of Central Line Associated Blood Stream Infections prevention, while participants from non-critical care unit had higher positive attitude toward the utility of the guidelines.

Conclusions: The results demonstrated room for improvement which could be achieved by innovative education and training and regular auditing of practice.

Introduction

Central line-associated bloodstream infections (CLABSI) are considered among the worst adverse events for hospitalized patients, and are particularly significant in critical care areas where central venous catheter (CVC) use is common and usually initiated (1–4). In the US alone, there are more than 4,000 CLABSI-related deaths annually, with around 21 additional hospital days and an extra cost of over USD 30,000 per patient (3). However, CVCs remain in high demand in critical care areas (4). CLABSI rates in non-critical care units are also high, and Studies noted that CLABSI rates tripled if they included other areas in addition to the intensive care unit (ICU), such as

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hemodialysis and oncology. It was also noted that CLABSI are the second leading cause of death among patients on hemodialysis (5,6).

According to the World Bank classification, the Kingdom of Saudi Arabia (KSA) is a high-income country, similar to most other Gulf Cooperation Council (GCC) countries (7). The healthcare system in the KSA is currently developing and upgrading to match standards in developed countries. However, official statistics about the rates of hospital-acquired infections are scarce. Few relevant scientific publications exist, although available studies reported the KSA had a higher than expected incidence of device related hospital-acquired infections (8–10). For example the risk for ventilator-associated pneumonia in ICU patients in the KSA and GCC countries is 217% higher than that in the US National Healthcare Safety Network, with higher device utilization ratios also reported in the KSA (9,10). A recent study was conducted by a National Guard hospital in the KSA that included six tertiary care hospitals in three Arabian Gulf countries (8). That study showed an overall CLABSI rate of 3.1 per 1,000 CVC days, which was 146% higher than rates reported by the Centers for Disease Control (CDC) and National Healthcare Safety Network hospitals. Another study conducted by the KSA General Directorate of Prevention and Infection Control, Ministry of Health, included seven adult and pediatric ICUs in five cities and reported a CLABSI rate of 4.5 per 1,000 CVC days, which was also significantly higher than CDC/National Healthcare Patient Safety Network rates (11).

The levels of knowledge and behaviors among nursing staff caring for patients with CVCs have been reported as an important contributor to decreasing or increasing the incidence of CLABSI and other hospital-acquired infections (3,12–15). Internationally, various studies have been conducted to evaluate critical care nurses' levels of knowledge, behavior, and attitudes regarding CLABSI prevention, and explore factors affecting these levels (16). Previous studies have also assessed the effect of guidelines or bundles of prevention on CLABSI prevention, and ultimately on patient care outcomes (11,15,17–21). The majority of the literature suggested that nurses had a relatively low level of compliance, but a positive attitude toward the use of CLABSI prevention guidelines (16,22). Within the ICU specialty area, specific factors have been reported to affect staff knowledge, such as ICU workload and staff shortages or turnover (16).

In the KSA, no exploratory studies focused on nurses' knowledge relating to CLABSI prevention have been conducted. Previous studies tended to focus on infection rates and application of evidence-based guidelines, which provided much needed information. However, these studies did not clarify levels of knowledge, behaviors, and attitudes among healthcare workers. The KSA also has an additional contributing factor that exacerbates this issue, as the majority of the nursing workforce comprises expatriate nurses; these nurses are from various geographical and social backgrounds and have varying educational levels, practices, and experience. Staff turnover is also high, as many expatriate nurses leave work in the KSA to return home or move to other international locations. Therefore, it is important to conduct regular studies to explore how nurses contribute to infection prevention in this context. It is also important to establish baseline data about nurses' levels of knowledge and behavior related to CLABSI, which will help to evaluate the effect of existing education programs, clarify the need for further education, and guide interventions for future CLABSI outbreaks. O'Grady et al. (2011) emphasized the need for competent staff to handle activities related to CVC management (23). Those authors noted that guidelines and protocols are essential tools to support staff practices and achieve higher compliance and improve skills in this area. In addition, Ramasethu (2017) highlighted the need for periodic reassessment of knowledge of and adherence to guidelines for all personnel involved in CVC insertion and maintenance (24).

This study will offer a helpful resource for hospitals in the KSA, and possibly more broadly in the region and internationally. Participants'

level of knowledge as determined by this study could help to verify staff education needs and may serve as a baseline record for evaluation of the effectiveness of future CLABSI prevention education programs. Information on nurses' behavior could also help to verify the results and processes of activities to monitor staff compliance in the departments involved in this study. Overall, information about participants' levels of knowledge, behavior, and attitudes will help to evaluate the current process of staff competency assessments regarding CLABSI prevention in the departments involved in this study. In addition, the results of this study will support investigations regarding CLABSI prevention events that may be associated with staff knowledge or compliance.

The objectives of this study were to determine levels of knowledge, behaviors, and attitudes regarding CLABSI prevention among nurses from critical and non-critical care units, compare those levels between nurses from critical and non-critical care units, and explore the possible associations between nurses' demographic characteristics and their levels of knowledge, behaviors, and attitudes regarding CLABSI prevention in the KSA.

Material and Methods
Study Design
This study used a quantitative, cross-sectional, comparative survey design.

Study Population and Sample
The accessible population included nurses in the adult ICU (critical care unit) and hemodialysis (non-critical care unit) departments in a Military Hospital in the KSA. Normally, these nurses would receive training and orientation on the local policy and international guidelines about the management and care for CVCs. The total size of the accessible population was 168 nursing staff, with 78 nurses in the adult ICU and 90 nurses in the hemodialysis unit. The total sampling technique was adopted because of the small size of the accessible population and the limited ability of the researcher to recruit more sites for this study. As 18 staff were on vacation at the

time of this study and therefore not available to participate, 150 questionnaires were distributed; 60 to the adult ICU and 90 to the hemodialysis unit. In total, 121 completed questionnaires were returned, giving an overall response rate of 81%.

The inclusion criterion for this study was staff nurses who were providing care for patients with CVCs in either the adult ICU or the hemodialysis unit at the time of data collection. Nurses who did not perform CVC care or did not have clinical duties (e.g., nurse assistants who are only responsible for assisting nurses handling patient care) and nurses in the orientation phase were excluded from this study.

Access to the study's hospital was approved by the Research Ethics Committee of the study hospital. An email inviting participation was sent to all nursing staff in the two study units via the hospital's nursing administration. An email reminder regarding the data collection process was sent after 4 weeks.

Data Collection
Instrument
For the purpose of this study, the questionnaire used for data collection was adapted from the questionnaire used by Esposito, Guillari, and Angelillo (2017). That questionnaire was developed and used in Italy to assess the knowledge, attitudes, and behaviors regarding CLABSI prevention among nurses in oncology and outpatient chemotherapy units (25). For this study, the CLABSI prevention questionnaire was reviewed based on the 2014 CDC guidelines.

The data collection instrument consisted of two parts with a total of 20 items. Part one recorded participants' demographics using six questions that covered: age, gender, educational level, years of experience in the current unit, unit of work, and job title. Part two included the CLABSI questionnaire, which addressed three elements related to evidence-based CLABSI prevention guidelines (knowledge, attitudes, and behavior). The CLABSI questionnaire was comprised of four sections with a total of 14 questions: two knowledge items (including 11 sub-items), four attitude items, five behavior

items (including 11 sub-items), and three items covering staff sources of information.

Data Collection Process

Data collection was conducted in July 2018. All nurses that were available during the data collection period were invited to participate. The data collection instruments were administered by the research team. Participants received a consent form and a leaflet that detailed the process of participation in the present research and noted the availability of the researcher to provide face-to-face explanations when needed. The time required to complete the questionnaire was around 20 minutes. After completing the questionnaire, participants placed their questionnaire in a sealed envelope, which was then deposited in a secured box that was kept in the unit manager's office until the end of the data collection period.

Data Analysis

Data were analyzed using SPSS version 23. Data were coded and entered into SPSS by the researcher, guided by statistical advice provided by a statistician as necessary to ensure an appropriate approach was adopted for the data analysis. Inferential statistics (T-tests) were used to compare participants' levels of knowledge and behaviors between the two units after exploring the data normality. Chi-square tests were used to explore associations between levels of knowledge and behaviors and participants' demographic variables (e.g., years of experience, gender, job title, level of education). Because of the non-normal distribution of the scores for attitudes, a Mann-Whitney test was used to compare participants' attitudes between the two participating units. Kruskal-Wallis and Mann-Whitney tests were used to determine if there were any associations between participants' attitudes toward CLABSI prevention guidelines and demographic characteristics (e.g., years of experience, gender, job title, level of education).

Reliability and validity

The data collection instrument was developed based on the CDC guidelines for the care of CVCs (23), which ensured the questionnaire had robust content validity. The content validity of the questionnaire was also assessed by the original authors in a population of 20 oncology nurses in Italy, which confirmed the clarity and readability of the questionnaire (25). For the purpose of this study, the validity of the questionnaire was assessed by an infectious disease consultant and an infection control nurse working in a military hospital in the KSA. These experts recommended rearranging the sequence of questions related to knowledge regarding CLABSI prevention to match CVC maintenance practices.

A pilot test involving a group of critical care nurses was conducted before the main data collection in this study. This aimed to confirm that the instrument was suitable for the ICU setting in military hospitals in the KSA. The pilot test included 12 nurses from adult and trauma ICUs. No changes were required based on the pilot study.

Ethical Considerations

Ethical approval was obtained from the RCSI Research Ethics Committee and the Research Ethical Committee of the hospital under study [Ref: REC244]. Participation in this study was voluntary and participants signed an informed consent form before participation. Data collection in this study was anonymous; no personal data that could identify the participants were collected. The participants were fully informed about all aspects of the study and their participation. All completed questionnaires were kept securely, and electronic data were kept in password encrypted files. Access to these files was limited to the researcher and the study supervisor.

Results

Participants' Demographics

Participants' demographic characteristics are presented in Table 1. The majority of participants (n=76, 63%) had less than 2 years of experience working in their current unit (mean 2.87±2.86 years). This relatively low level of experience reflected the age of participants, as most were younger than 40 years (n=107, 89%). Most participants (n=107,

89%) held a bachelor's degree in nursing, and 97% (n=117) held the job title of staff nurse. Overall, there were minor variations in demographic characteristics between participants in the two units.

Table 1. Participants' demographic data (N=121)

		n	%
Age, years	20–30	66	55
	31–40	41	34
	41–50	11	9
	51–60	2	2
	61–70	1	1
Gender	Male	33	27
	Female	88	73
Years of experience	0–2	76	63
	2–5	20	17
	5–10	15	12
	More than 10	3	3
Education	Diploma	11	9
	Bachelor's degree	107	88
	Master's degree	3	3
Unit	Hemodialysis	67	55
	Adult ICU	54	45
Job title	Staff nurse	117	97
	Charge nurse	2	2
	Head nurse	1	1

Note: ICU, intensive care unit.

Knowledge of CLABSI Prevention

Of a total possible score of 11, participants' overall mean score for knowledge of evidence based CLABSI prevention guidelines was 7.57±1.75. Adult ICU (critical care) participants had a higher mean knowledge score compared with hemodialysis unit (non-critical care) participants (8.89±1.30 vs. 6.48±1.27).

There was a significant difference in the scores for knowledge regarding CLABSI prevention between adult ICU and the hemodialysis unit participants (P<0.000). The chi-square test showed a significant association between participants' knowledge score and their years of experience.

Table 2. Participants' Knowledge related to CLABSI Prevention (N=121)

No.	CLABSI prevention evidence-based knowledge questions	% Correct	% Incorrect	% Do not know
1	Use sterile gauze or sterile transparent semi-permeable dressing to cover the catheter site?	97	3	0
2	Flush the CVC lumen with saline after the administration of medication or fluid?	96	3	0
3	Disinfect the CVC needleless connectors before administer medication or fluid?	92	5	0
4	Replace the IV administration sets every 72 hours?	89	9	1
5	Disinfect the catheter insertion site with hydrogen	78	16	4

No.	CLABSI prevention evidence-based knowledge questions	% Correct	% Incorrect	% Do not know
	peroxide?			
6	For patients 18 years of age or older, use a chlorhexidine impregnated dressing?	69	14	12
7	Replace catheter site dressing every 7 days for sterile semipermeable dressing or if the dressing becomes visibly soiled or loosened?	61	38	0
8	Avoid tincture of iodine for cleansing of the umbilical central line insertion site?	54	27	12
9	Routine use of anticoagulants solutions in the CVC lumens?	41	52	6
10	Use topical antibiotic ointment on catheter insertion site?	36	59	3
11	Bathe ICU patients over 2 months of age with a chlorhexidine preparation on a daily basis?	32	36	30

Note: CLABSI, central line-associated bloodstream infections; CVC, central venous catheter, ICU, intensive care unit, IV, intravenous.

Behaviors relating to CLABSI Prevention

Of a total possible score of 11, the mean behavior score related to CLABSI prevention practices was 6.79±1.82. Adult ICU (critical care) participants had a higher mean behavior score compared with hemodialysis unit (non-critical care) participants (7.37±1.74 vs. 6.31±1.76). There was a significant difference in participants' score for CLABSI prevention behaviors between the two units (P<0.001). However, there were no significant associations between participants' behavior score and their demographic characteristics (i.e., age, gender, experience in the current unit, level of education, job title).

Table 3. Participants' behaviors related to CLABSI Prevention (N=121)

No.	CLABSI prevention behaviors	Appropriate performance n (%)	Inappropriate performance n (%)	Missing %
1	Do you clean the CVC site before disinfection?	111 (92)	4 (3)	(5)
2	Do you allow the antiseptic solution to dry before proceeding with changing the dressing on the CVC insertion site?	109 (90)	9 (7)	(3)
3	What do you use for flushing the CVC lumens after IV therapy?	106 (88)	3 (3)	(10)
4	For how long do you wash your hands before changing the dressing on the CVC insertion site?	99 (82)	13 (11)	(7)
5	Do you allow the antiseptic solution to dry after applying it on the CVC access port before proceeding with administering therapy?	96 (79)	16 (13)	(7)
6	How many hours after the infusion with lipid emulsions do you replace the administration sets?	71(59)	32 (26)	(15)
7	How many hours after the infusion with blood	68 (56)	36 (30)	(14)

No.	CLABSI prevention behaviors	Appropriate performance n (%)	Inappropriate performance n (%)	Missing %
	and blood products do you replace the administration sets?			
8	What do you use to clean the CVC site before disinfection?	56 (46)	40 (33)	(21)
9	For how long do you allow the antiseptic solution that was used for the disinfection of the CVC access port to dry before proceeding with administering therapy?	40 (33)	52 (43)	(24)
10	After how many days do you replace the sterile transparent semi-permeable dressing	38 (31)	70 (58)	(11)
11	For how long do you allow the antiseptic solution to dry before proceeding with CVC site dressing change?	27 (22)	78 (65)	(13)

Note: CLABSI, central line-associated bloodstream infections; CVC, central venous catheter, IV, intravenous.

Attitudes towards CLABSI Prevention

Participants' attitudes toward CLABSI prevention were surveyed by assessing their responses to three major elements on a scale from 1–10. The Mann-Whitney test showed that nurses from the hemodialysis (non-critical care) unit had more positive attitudes towards the use of CLABSI prevention guidelines, although this was only significant for hand hygiene before and after the replacement of CVC dressings to reduce CLABSI (P<0.017). The association between demographic characteristics and CLABSI prevention attitudes was assessed using Kruskal-Wallis and Mann-Whitney tests because the attitude scores were not normally distributed. The results showed there were independent significant associations between participants' level of education and their attitudes regarding the usefulness of CLABSI prevention guidelines and perceptions of the risk for transmitting CLABSI when handling the CVC. However, attitude scores had no significant association with the use of hand hygiene before and after replacing dressings to reduce CLABSI. Furthermore, the results showed no significant associations between participants' attitudes and other demographic characteristics (i.e., age, job title experience, and gender).

Table 4. Attitudes toward CLABSI prevention guidelines (N=121)

Attitude	Mean (max 10)	SD
How useful do you think the CLABSI prevention guidelines are? (One indicates useless and 10 indicates very useful)	9.12	1.44
How do you perceive your risk for transmitting a CLABSI when handling the CVC? (One indicates useless and 10 indicates very useful)	7.10	2.87
How would you rate the use of hand hygiene before and after the replacement of dressings to reduce CLABSI? (One indicates no risk and 10 indicates very high risk)	9.42	1.34

Note: CLABSI, central line-associated blood stream infections; CVC, central venous catheter.

Participants' Sources of Information

The majority of participants (84%, n=102) referred to local guidelines as their source of information, followed by workshops and courses (34%, n=41) and colleagues (23%, n=28). In addition, 64% (n=72) of participants thought they needed more information about CLABSI and 60% (n=67) thought they needed more training about this issue.

Discussion

The present study showed that participating nurses had an adequate level of knowledge and positive attitudes regarding evidence-based CLABSI prevention guidelines compared with their international counterparts (16,22,25–30). Nurses' level of knowledge was positively correlated with their years of experience but not with their level of formal education, which was consistent with international statistics (22,26,29,31,32). Nurses perceived there was a risk for transmitting CLABSI when handling CVCs. The highest perceived risk for transmitting CLABSI was reported by nurses with a lower level of education, which was consistent with a previous study (25), and nurses with a higher job title. This higher perception of risk among specific groups of nurses may contribute to being junior or holding higher responsibility. Bianco et al. (2013) identified various factors that may contribute to positive staff attitudes regarding the use of CLABSI prevention guidelines, including written policies, formal training, and years of experience (26).

The present results suggested that although there remains room for improvement in CLABSI prevention knowledge, the main challenges that explain the higher rates of CLABSI in clinical settings may be related to nurses' behaviors and practices (i.e., compliance). This study found that nurses exhibited an adequate level of behavior regarding the appropriate performance of evidence-based CLABSI prevention practices. Participants' scores were not much higher than a "passing" score (6.8/11). This low level of practice and behavior is of concern, and has also been reported in international studies (14,16,28). These results confirm that a major target for improvement is nurses' CLABSI

prevention behaviors.

The results of the present study showed that longer experience contributed to higher knowledge, but less compliant behavior regarding CLABSI prevention guidelines compared with fewer years of experience. Non-compliant behaviors may be acquired by nurses and accumulate over time, ultimately leading to a gap between nurses' knowledge and their behavior. Regular assessment of nurses' levels of knowledge, behaviors, and attitudes may help in detecting and addressing such gaps. This assessment could be integrated into annual competency assessment programs for all nurses. However, such assessment should focus on nurses' actual practices rather than their knowledge of guidelines and policies. Moreover, regular monitoring of nurses' compliance with evidence-based CLABSI prevention guidelines and reporting CLABSI rates will help to raise awareness about the low compliance rates and clarify when further review and intervention is needed.

Integration of evidence-based CLABSI prevention guidelines in the formal education curricula for undergraduate and postgraduate nursing training programs as well as in continuous professional development programs is needed. However, these educational activities should focus on innovative methods that produce sustainable behavioral changes, rather than just short-term knowledge increases and behavior changes; for example, simulation based training (3,13) or other innovative methods. However, it should be noted that such approaches will be suboptimal if barriers to staff achievement of higher levels of knowledge and behavior are not addressed. These barriers include staff-to-patient ratios, work overload, and lack of time. Strategies that involve all levels of management in hospitals and regulatory organizations should be considered to promote better work environments that allow staff sufficient time to update their information and improve their knowledge and behaviors. Similarly, barriers that hinder staff access to research and updated information (e.g., enhancing staff skills on interpreting research and lack of time) should be addressed and resolved to provide settings that

offer staff opportunity to access and understand relevant research.

Nursing management across all levels of hospitals and regulating bodies should work on integrating evidence-based CLABSI prevention guidelines into nurses' continuous professional development activities and annual evaluations, and conduct regular auditing activities. In addition, nursing managers should communicate with educators in academic institutions to strengthen the elements focused on infection control and prevention in formal education curricula and developing postgraduate training programs that cover those guidelines. Health organizations also need to develop local practice protocols to promote compliance with evidence-based guidelines and bridge the gap between healthcare workers' practices and research findings (26).

Previous studies that were conducted in the KSA considered CLABSI prevention by monitoring patients and infection rates, which provided important information (10,11,17). However, it would be helpful if more, larger national descriptive and exploratory studies were conducted that address staff knowledge, performance, and attitudes to develop a wider picture of CLABSI prevention measures in the KSA. Future descriptive studies could also benefit from supporting their results through reporting correlations with infection rates or monitoring staff compliance. Monitoring of staff compliance could be explored using covert observational studies and qualitative methodologies to allow better understanding of staff behaviors that may contribute to the problem.

Conclusions and Recommendations

This was the first research conducted in the KSA that has assessed nurses' levels of knowledge, behaviors, and attitudes regarding CLABSI prevention. It is also the first study to compare these factors between nurses in critical and non-critical care units in the KSA.

It could be concluded from this study that staff nurses' competency regarding evidence-based CLABSI prevention can be improved. The improvement should focus on sustaining the high quality clinical practices in addition to

updating their theoretical base.

Regular education and training programs using innovative teaching methods such as simulation together with integration of updated evidence in local guidelines and hospital policies are possibly the way forward. Similarly, it would be helpful to regularly assess nurses' knowledge about and compliance with evidence-based CLABSI prevention guidelines to clarify their educational needs and identify any possible decline in relevant knowledge, behavior, and attitudes, especially in the context of high staff turnover and work overload. Educational levels were significantly associated with better attitudes toward CVC management, therefore higher educational preparation could be considered by recruiter in the selection of staff for these highly critical areas.

Finally, barriers to staff learning processes and expected high level practice (e.g., work overload, high staff-to-patient ratio, and lack of time) should be addressed.

Limitations of this Study

The small sample size in this study means that generalization of the results to other areas is limited. The use of a self-report questionnaire was associated with difficulties in verifying participants' responses and resulted in some missing data. The self-report questionnaire might also have introduced self-report bias, which could not be verified in the present study setting.

The clinical areas included in the study may have different clinical contexts which might have acted as confounding factors to the occurrence of the CLABSI infections in one more than the other. For example, ICU patients remain in the unit all through their treatment period under the strict observation and care of the staff. Renal dialysis patients in the other hand are usually discharged home with bigger role in caring for their central lines.

Finally, the number of shifts and contact hours with each patient who have a central line, and the patient loads for staff working with patients with CVC could be factors that affect staff non- compliance. However, this could not be accounted for within this study.

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الوقاية من عدوى مجرى الدم المرتبطة باستخدام القسطرات الوريدية الرئيسة: معرفة واتجاهات وسلوكيات الممرضين في المملكة العربية السعودية، دراسة مقارنة بين اقسام العناية المركزة واقسام العناية غير المركزة

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الملخص

أهداف الدراسة: هدفت هذه الدراسة إلى تقييم مستوى المعرفة والسلوك والاتجاهات لدى الممرضين في وحدات العناية المركزة ووحدات غسيل الكلى في مستشفى عسكري في المملكة العربية السعودية فيما يتعلق بالوقاية من عدوى مجرى الدم الناتج عن استخدام القسطرات الوريدية الرئيسة (Central Line Associated Blood Stream Infections).

طريقة البحث: اعتمد هذا البحث على التصميم المقطعي المقارن باستخدام استبيان مكون من 20 سؤال بحثي. تم جمع البيانات في يوليو 2018 بمعدل استجابة 81٪. تضمنت العينة الإجمالية 121 من أقسام العناية الحثيثة وغسيل الكلى.

نتائج الدراسة: أظهرت النتائج أن المشاركين لديهم مستوى كافٍ من المعرفة والسلوك فيما يتعلق بالإرشادات المسندة بالأدلة للوقاية من عدوى مجرى الدم المرتبطة باستخدام القسطرات الوريدية الرئيسة، وارتبط مستوى معرفة المشاركين بشكل كبير بسنوات خبرتهم، وكان للمشاركين مواقف إيجابية للغاية فيما يتعلق باستخدام المبادئ التوجيهية القائمة على الأدلة الوقائية. وكان لدى المشاركين من وحدة الرعاية الحرجة مستوى أعلى من المعرفة والسلوك فيما يتعلق بالإرشادات المسندة بالأدلة للوقاية من عدوى تدفق الدم المرتبطة باستخدام القسطرات الوريدية الرئيسة، بينما كان لدى المشاركين من وحدة الرعاية غير الحرجة موقف إيجابي أعلى تجاه فائدة المبادئ التوجيهية.

الأستنتاجات: أظهرت نتائج الدراسة الحاجة لتحسين الممارسات العملية للعاملين في وحدات العناية بالمرضى تلك المشابهة للمشمولة بالدراسة، وهذا التحسين يمكن تحقيقه من خلال التعليم والتدريب المستمر والمستند إلى طرق مبتكرة تحدث تغيير طويل الأمد إضافة إلى أهمية المراجعة المنتظمة للممارسا ت ومراقبة اداء العاملين الصحيين.

الكلمات الدالة: عدوى مجرى الدم المرتبطة باستخدام القسطرات الوريدية الرئيسة، مستوى المعرفة لدى الممرضين، سلوكيات الممرضين، اتجاهات الممرضين، الوقاية من العدوى، الممرضين، العناية الحثيثة، غسيل الكلى، المملكة العربية السعودية.