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NURSES' KNOWLEDGE TOWARDS CLINICAL DECISION-MAKING TOOLS OF PERIPHERAL INTRAVENOUS CATHETER ASSESSMENT

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Abstract: *Inadequate decision-making can contribute to a higher incidence of complications associated with peripheral intravenous catheters, such as infection, occlusion, dislodgement, and thrombosis. These complications not only harm patients but also contribute to the financial burden on healthcare systems. Purpose: This study aimed to assess the knowledge of nurses towards clinical decision-making tools of peripheral intravenous catheters. Methodology: A cross-sectional study involved 75 nurses from the medical and surgical wards of a teaching hospital in the East Coast region. Nurses' knowledge was assessed using a self-administered questionnaire. Data were analysed with descriptive analysis. Result: The nurses' level of clinical decision-making of PIVC assessment tools was determined by the summation of the total score of the 19 questions. There are about 10 nurses (13%) who answered all the questions correctly. The statistical test shows that only 4% of nurses have a moderate level of knowledge score while about 96% of nurses have a good level of knowledge score. Conclusion: This study showed that nurses know the clinical decision-making tools of peripheral intravenous catheter assessment. Regular educational programmes and audits would sustain the good nursing practice of peripheral intravenous catheter assessment.*

Keywords: *nurse, nurses' knowledge, peripheral intravenous catheter assessment, clinical decision-making tools*

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Introduction

The peripheral intravenous catheter (PIVC) is the primary device used to administer intravenous fluids and medications prescribed. While the insertion of a PIVC serves numerous functions in enhancing a patient's condition, it also carries certain disadvantages that can lead to complications, particularly at the insertion site (Evison et al., 2022). Since the insertion of PIVC involves invasive procedures, it is essential to ensure consistent practices during catheter insertion, management, and ongoing monitoring (Santos-Costa et al., 2022). According to Ray-Barruel et al. (2019), up to 69% of PIVCs experience painful complications or fail prematurely due to occlusion, dislodgement, infiltration, or phlebitis.

Alexandrou et al. (2015) have identified various factors contributing to PIVC failure, including characteristics of the inserter, patient-related factors, anatomical placement, and adherence to international best practices and infection control guidelines within healthcare facilities. Throughout history, ethical principles such as beneficence and non-maleficence have guided clinical decision-making to prevent unnecessary harm to patients (Carr et al., 2019). These principles are crucial in determining the appropriateness of PIVC placement, aiming to uphold vessel health and preservation (Carr et al., 2019). Furthermore, clinical decision-making tools play a pivotal role in assessing whether the insertion of PIVCs is clinically justified for each patient (Carr et al., 2019). Moreover, PIVC failure rates and complication incidence are alarmingly high, reaching up to 48% (Blanco-Mavillard et al., 2019). This means that approximately 1 out of every 2 catheters fails to last for 5 days or until the completion of treatment. These findings underscore the significant challenges associated with maintaining PIVC, highlighting the importance of proactive management and adherence to best practices in clinical settings. Moreover, this contributes significantly to healthcare system waste and results in increased pain, workload, and the need for replacement devices (Rickard & Ray-Barruel, 2017). Therefore, this study was conducted to examine the nurses' practice level in clinical decision-making for early detection of PIVC complications.

Literature Review

Clinical decision-making tools for peripheral intravenous catheter assessment

The clinical decision-making tools for assessing PIVCs encompass various approaches aimed at improving care quality and patient outcomes. One assessment tool is the I-DECIDED developed by Ray-Barruel et al. (2020), designed to enhance the assessment and documentation practices of PIVCs. This tool incorporates structured questionnaires covering essential elements such as the necessity of the PIVC, its functionality, complications, infection prevention, dressing, patient education, and documentation. It utilizes both categorical binary responses and a 4-point ordinal scale and includes assessing patient knowledge as a crucial component.

Another valuable tool in clinical decision-making is the use of Clinical Practice Guidelines (CPGs), as highlighted by Oh et al. (2019). CPGs provide evidence-based recommendations to guide nursing care, thereby optimizing decision-making and improving patient safety. Adopting updated CPGs has been shown to extend PIVC dwell time, reducing unnecessary replacements and patient discomfort without increasing complications. This approach is particularly beneficial for novice nurses who rely on trustworthy guidelines to support their clinical decisions.

Additionally, Carr et al. (2019) introduced the A-PIVC Aid assessment tool, which combines clinician experiences, knowledge, and checklist-based observations to guide PIVC insertion

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decisions. This method integrates scientific evidence with clinician judgment, evaluating factors such as clinical procedures requiring intravenous therapy, prescribed IV fluids and medications, and the presence of pre-existing PIVCs. It emphasizes the concept of vessel health and the importance of selecting the appropriate device for infusion to enhance patient outcomes.

Each of these tools plays a critical role in improving the quality of care surrounding PIVC management. The I-DECIDED tool supports structured assessment and decision-making, CPGs provide evidence-based recommendations, and the A-PIVC Aid integrates clinical judgment with checklist observations. These tools cater to a range of clinical expertise levels, from novice to experienced nurses, ensuring that PIVC management aligns with best practices and enhances patient safety and comfort.

The level of nurses' knowledge of clinical decision-making tools of PIVC

Knowledge is a crucial factor contributing to the assessment of clinical decision-making tools because adequate knowledge can minimize the failure rate and complications faced by patients during insertion. Nurses' knowledge is influenced by their level of education and years of experience. According to Keleekai et al. (2016), evidence shows that the success of the first attempt at PIVC insertion is related to nurses' knowledge, confidence, skills, and the involvement of expert nurses, which can reduce complications. The authors identified several knowledge deficits in PIVC assessment, such as patient assessment, insertion site selection, catheter selection and insertion, catheter securement, dwell time, complication identification and treatment, adherence to practice guidelines, and education.

Additionally, Yilmaz et al. (2023) conducted a study to assess nurses' knowledge regarding the prevention of peripheral intravenous therapy complications, which can occur due to improper assessment of PIVC. The study found that while participant nurses scored high in knowledge regarding prevention, their independent variables did not significantly affect their knowledge scores (Yilmaz, et al., 2023). Nurses were categorized as having low knowledge if their mean score was between 0 and 40, moderate knowledge if between 41 and 70, and high knowledge if between 71 and 100. Despite obtaining a high level of knowledge, there was no statistically significant relationship found between their socio-demographic factors and knowledge levels.

Several nurse variables significantly influence the success rate of PIVC assessment. According to Qamar et al. (2017), nurses' age, years of experience as registered nurses, the number of PIVC insertions performed per week, self-rated PIVC insertion skills, and speciality certification were significantly different between successful and failed insertion attempts. Furthermore, the authors noted that older nurses with more experience, higher self-rated PIVC insertion skills, and speciality certification were more likely to have successful insertions. Hassan et al. (2022) also found that nurses' age was associated with their level of knowledge; older nurses tended to have higher knowledge of PIVC insertion.

Another significant factor is nurses' years of experience. Nurses with more experience have significantly higher success rates in PIVC insertion compared to those with less experience (Qamar et al., 2017). Osti et al. (2019) similarly found that nurses with more years of experience had greater knowledge of PIVC assessment, whereas junior nurses with less than a year of experience lacked sufficient knowledge. There was a positive correlation between knowledge and years of experience; longer working experience was associated with higher knowledge in PIVC insertion. Age is a significant factor; older nurses, with more years of experience, often have more successful PIVC insertion rates due to their accumulated experience (Wafaa-El-

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Sayed et al., 2019). Additionally, Osti et al. (2019) revealed that nurses with less than a year of experience lacked sufficient practical knowledge, which improves with longer working tenure as they gain more experience and skills, potentially through pursuing further education and obtaining speciality certification.

Certification in a speciality is another significant factor affecting successful PIVC insertion rates. Hassan et al. (2022) found that nurses certified in a speciality had higher success rates in PIVC insertion compared to those without certification. Keleekai et al. (2019) noted a lack of research comparing the knowledge, confidence, and skills of nurses receiving minimal versus extensive PIVC education. Meanwhile, Yilmaz et al. (2023) found that nurses' level of education influences their knowledge; those with postgraduate education scored higher in PIVC assessment knowledge. Hence, further education enhances nurses' knowledge through research and coursework, exposing them to new practice guidelines.

Methodology

A quantitative cross-sectional study was conducted from February to April 2023 using convenient sampling. The target population consisted of 173 nurses working in the general medical and surgical wards. The Raosoft sample size calculator was employed for the study, with a 5% margin of error, a 90% confidence interval, and a 50% response rate. Consequently, the required sample size for this study was 120 participants. Due to several limitations encountered during the study, the researcher employed disproportionate sampling to recruit participants. Ultimately, a minimum sample size of 65 participants was deemed sufficient from the total of 173 nurses.

The inclusion criteria encompassed nurses work in the general medical and surgical wards. The exclusion criteria applied to nurses who declined to participate in the study. The questionnaire was distributed via WhatsApp link to self-reported Google forms to the nurses, and all participants were required to fill out a consent form before proceeding to the questionnaire. Subsequently, the researchers compiled and reviewed all the questionnaires to identify and isolate any incomplete submissions. Out of the 113 questionnaires received from the participants, 38 were deemed incomplete, leaving a total of 75 fully completed questionnaires for analysis.

A questionnaire consists of 22 items divided into three sections. Part A consists of 5 items on sociodemographic status which were gender (male/female), age, level of education (diploma/bachelor degree), year of experience and post-basic certification. Part B consists of 19 items related to the level of knowledge on clinical decision-making in PIVC assessment. All items were measured on a nominal scale: 'yes', 'no', and 'I don’t know'. The data were categorized into levels of poor, moderate, and good knowledge. Written informed consent was obtained from all participants before data collection. This study was approved by the Institutional Review Board (IRB) committees (IIUM/504/14/11/2/IREC 2022-KON).

Results

Characteristics of study participants

Table 1 displays the characteristics of the study participants. A total of 75 participants completed the survey questionnaire and were included in the final analysis. The majority of participants were female (n=62, 82.7%), while 13 (17.3%) were male. There were 58 participants (77.3%) aged between 21 and 30 years old, followed by 17 participants (22.7%)

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aged between 31 and 40 years old. Furthermore, 49 participants (65.3%) had 1 to 5 years of nursing experience, and 26 participants (34.7%) had 6 to 10 years of nursing experience. The majority of participants held a diploma (n=65, 86.7%), followed by bachelor's degree holders (n=10, 13.3%). In terms of post-basic certification, 48 participants (64%) were certified, while 27 participants (36%) were not.

Table 1: Socio-demographic data of participants (N=75)

Variables		Frequency	Percentage (%)
Gender	Male	13	17.3
	Female	62	82.7
Age	21-30	58	77.3
	31-40	17	22.7
Years of experience in nursing	1-5	49	65.3
	6-10	26	34.7
Level of education	Diploma	65	86.7
	Degree	10	13.3
Post basic certification	Yes	48	64
	No	27	36

The level of nurses' knowledge of clinical decision-making of PIVC

Table 2 presents the level of nurses' knowledge of clinical decision-making tools of PIVC. The study showed that 72 (96%) nurses have a good level of knowledge on clinical decision-making of PIVC assessment and only 3 (4%) nurses have a moderate level of knowledge on clinical decision-making of PIVC assessment. There are none of the nurses have a poor level of knowledge based on clinical decision-making of PIVC assessment.

Table 2: The level of nurses' knowledge of clinical decision-making of PIVC

Variables		Frequency (n)	Percentage (%)
Knowledge of thenurses	Total score		
Poor	0-15	0	0
Moderate	16-26	3	4
Good	27-38	72	96

Table 3 presents the participants' responses to the questionnaires. The majority of participants answered questions correctly, with over 90% agreeing that the cannula gauge of 14−20 G is suitable for adult patients and 22−24 G for paediatric patients, PIVC can be used for 48–72 hours without signs of complications, phlebitis is the most identifiable infection, environmental sanitation influences the risk of PIVC infections, wearing non-sterile gloves during PIVC insertion is advisable, transparent dressings aid in identifying early signs of infection, patient education on PIVC care is important for infection risk reduction, and PIVC should be flushed with normal saline after any intravenous medication. All participants correctly answered that hand hygiene before PIVC insertion prevents infection. Only five questions had responses of "I don't know" from participants, namely regarding the cannula gauge for adult and paediatric patients, phlebitis as the most identifiable infection, hand hygiene before PIVC insertion preventing infection, the importance of maintaining aseptic technique throughout PIVC insertion, and the necessity of skin preparation at the insertion site.

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Table 3: Nurses' knowledge of clinical decision-making of PIVC

	Frequency (n, %)		
Questions	**Correct**	**Wrong**	**I don'tknow**
1. The cannula gauge 14−20 G is suitable in adultpatients and 22−24 G in pediatric patient	70 (93.3)	5 (6.7)	
2. Veins at the dorsal and ventral surface of the upperextremities are used for IV cannulation	66 (88)	5 (6.7)	4 (5.3)
3. Peripheral IV cannula must be removed every 12–72 hours from insertion time.	37 (49.3)	32 (42.7)	6 (8)
4. IV cannula can be used within 48–72 hours if no signsand symptoms of a complication.	68 (90.7)	3 (4)	4 (5.3)
5. Phlebitis is the most identifiable infection.	73 (97.3)	2 (2.7)	
6. The environment sanitation influences the risk of IVinfection.	70 (93.3)	3 (4)	2 (2.7)
7. Hand hygiene before IV cannula insertion prevents infection.	75 (100)		
8. Maintaining aseptic technique only during IV insertion helps to prevent infection.	57 (76)	18 (24)	
9. Wearing non-sterile gloves during IV cannula insertion is advisable.	68 (90.7)	6 (8)	1 (1.3)
10. Skin preparation at the insertion site is essential.	64 (85.3)	11 (14.7)	
11. Increasing attempts for cannulation will increase the risk of infection.	63 (84)	7 (9.3)	5 (6.7)
12. Transparent dressing will help to recognize early signs and symptoms of infection.	71 (94.7)	3 (4)	1 (1.3)
13. Removing the extra IV cannula will help to reduce the risk of infection occurs.	64 (85.3)	7 (9.3)	4 (5.3)
14. Staphylococcus aureus is the most associated with cannula tips.	44 (58.7)	12 (16)	19 (25.3)
15. Catheter material, size, duration, the experience of the staff etc. influence the risk of infection.	51 (68)	19 (25.3)	5 (6.7)
16. IV therapy increases the risk of IV infection.	40 (53.3)	28 (37.3)	7(9.3)
17. Patients with PIC are at risk of nosocomial infection.	56 (74.7)	10 (13.3)	9 (12)
18. Patient education on the care of IV cannula is important to reduce the risk of infection.	70 (93.3)	2 (2.7)	3 (4)
19. The IV cannula should be flushed by injection of normal saline after any IV medication.	68 (90.7)	3 (4)	4 (5.3)

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Association between demographic characteristics and knowledge on clinical decision-making of PIVC

Table 4 indicates that there were no significant associations found between age and knowledge level (p=1.00), gender and knowledge level (p=0.44), years of experience and knowledge level (p=0.55), level of education and knowledge level (p=0.35), or post-basic certification and knowledge level (p=0.29) using Fisher's Exact Test.

Table 4: Association between demographic characteristics and knowledge of clinical decision-making of PIVC.

Variables	Knowledge level, n (%)		*p-value*
	Moderate	**Good**	
Age			
21-30	3 (4%)	55 (73.3%)	1.00
31-40		17 (22.7%)	
Gender			
Male	1 (1.3%)	12 (16%)	0.44
Female	2 (2.7%)	60 (80%)	
Years of experience			
1-5	3 (4%)	46 (61.3%)	0.55
6-10		26 (34.7%)	
Level of education			
Diploma	2 (2.7%)	63 (84%)	0.35
Degree	1 (1.3%)	9 (12%)	
Post basic certification			
Yes	2 (2.7%)	25 (33.3%)	0.29
No	1 (1.3%)	47 (62.7%)	

Discussion

This study suggests that the majority of nurses possess good knowledge, which is promising considering this is a teaching hospital. Similar studies by Osti et al. (2019) have also found that most nurses had good knowledge of caring for and maintaining peripheral IV cannulation. However, there were still some nurses lacking proper knowledge and experience in IV cannulation, posing potential risks to patient safety. They attributed this mainly to junior nurses with less than a year of working experience, whose knowledge of IV cannula care and maintenance was limited, potentially leading to incorrect practices. Additionally, according to Yilmaz et al. (2023), nurses demonstrated high knowledge levels, but their practices in preventing PIVC complications varied. Overall, nurses scored highly (81.54±12.06; min: 50, max: 100) on 10 questions related to practices for preventing PIVC complications, indicating awareness of routine care for preventing such complications. Conversely, a study by Hassan et al. (2022) reported that only 27.3% of nurses had high knowledge of PIVC insertion, while 72.7% had low knowledge. Together with previous studies, it can be concluded that nurses generally have good knowledge of PIVC assessment decision-making, although contradictory results exist in some studies.

There was no significant difference was found between socio-demographic factors and levels of knowledge recorded. Similarly, Yilmaz et al. (2023) reported no statistically significant difference in scores related to nurses' gender, length of employment in the health profession,

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type of work, training received related to PIT complications, and self-competence level in PIVC complications. However, nurses with postgraduate education achieved higher mean scores in terms of knowledge (Yilmaz et al., 2023). This suggests that advanced training after graduation in PIVC insertion and complications likely contributes to higher levels of knowledge among nurses. The authors also concluded that while participant nurses scored highly in knowledge regarding the prevention of PIT complications, their independent variables did not significantly affect their knowledge scores. However, differences were observed in nurses' practices toward preventing PIT complications, emphasizing the importance of translating acquired knowledge into clinical practice. It is noted, however, that having a high level of knowledge regarding PIVC insertion and complications does not guarantee good practice in applying that knowledge.

Furthermore, a similar study by Hassan et al. (2022) found that older age among nurses was associated with higher knowledge levels in PIVC insertion. Additionally, a positive correlation was found between knowledge and years of working experience, indicating that longer experience leads to higher knowledge in PIVC insertion. On the other hand, the level of education and the unit or ward where nurses work were not associated with knowledge levels across different educational levels ($p=0.804$), consistent with findings in the current study. However, Hassan et al. (2022) noted that despite nurses generally following PIVC insertion procedures according to standards, a majority lacked knowledge in certain important areas and omitted proper steps during insertion. This contrasts with the findings of the current study and underscores ongoing challenges in aligning knowledge with practice in clinical settings.

Conclusion

In conclusion, the study reveals that a significant majority of nurses demonstrate a commendable level of knowledge regarding clinical decision-making tools for PIVC assessments. This high level of competence reflects their ability to effectively manage PIVC procedures, including cannula selection, maintenance practices, and early complication detection. The small percentage of nurses with moderate knowledge underscores the need for targeted educational interventions to further enhance their proficiency in PIVC-related assessments. Furthermore, the study found no significant associations between demographic factors such as age, gender, years of work experience, level of education, and post-basic certification with nurses' knowledge levels in PIVC assessments. This suggests that standardized training and ongoing professional development initiatives play a crucial role in ensuring uniform competence across diverse nursing profiles. Future efforts should focus on integrating evidence-based practices and continuous education to continually improve patient outcomes and safety in PIVC management.

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