

Improving Success Rates and Reducing Complications in Intravenous Cannulation: Knowledge and Practice on Peripheral Intravenous Catheterisation among Nurses of Armed Forces Hospital-King Abdulaziz Air Base in Dhahran, Saudi Arabia

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Abstract

This study systematically examines the knowledge and practices of Peripheral Intravenous Catheterization (PIVC) among nursing professionals at the Armed Forces Hospital in King Abdulaziz Air Base (AFH-KAAB) in Dhahran, Saudi Arabia. The primary objective is enhancing success rates and minimising complications associated with intravenous cannulation through improved training methodologies. Employing a mixed-methods approach, this research integrates qualitative insights from clinical practice and focus group discussions with quantitative data analysis. Data were collected using a self-administered survey and analysed using SPSS Version 29. The survey encompassed socio-demographic information, sources of knowledge concerning PIVC, and specific practices associated with PIVC. The findings reveal that socio-demographic factors significantly impact knowledge and practice levels, underscoring the need for tailored educational resources. The study concludes that implementing targeted interventions to enhance nurses' knowledge and skills in PIVC can significantly improve patient safety, increase success rates, and lead to more favourable healthcare outcomes. These findings provide critical insights for developing customized training programs and educational initiatives to elevate nurses' competency and proficiency in PIVC. Ultimately, these efforts contribute to achieving zero harm in intravenous care and optimising healthcare quality by reducing patient harm.

Keywords: Improving Success rates, Reducing complications, Intravenous cannulation, infiltration, Cannulation, Total Parental Nutrition (TPN), Peripheral intravenous catheterisation, Knowledge, Practice, Nurses.

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INTRODUCTION

Ensuring accurate insertion of peripheral intravenous (IV) lines is crucial for administering medications, fluids, and blood products in medical care. However, improper placement can lead to severe complications such as infiltration, extravasation, and infection. Consequently, nurses must be well-trained in peripheral intravenous catheterisation techniques to mitigate these risks and ensure patient safety. This research focused on nurses at the Armed Forces Hospital in King Abdulaziz Air Base (AFH-KAAB) in Dhahran, Saudi Arabia, delves into the existing knowledge and skills pertinent to this essential practice.

A brief survey of previous studies highlights critical issues in peripheral intravenous (PIV) therapy knowledge and practice across various settings. For instance, Alamri *et al.*, (2014) found significant gaps in infection prevention protocols and appropriate equipment selection among Saudi nurses. Aryan *et al.*, (2018) demonstrated the impact of clinical experience on PIV outcomes, noting higher success rates and fewer complications among more experienced nurses. Additionally, Morrell *et al.*, (2018) explored the efficacy of brief, "Just-in-Time" training modules, observing improved PIV competence over time. Notably, the Royal College of Nursing (RCN) guidelines emphasise best practices and the necessity of competency assessments. However, they do not specify evaluation methods.

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Furthermore, reviews and research such as those by Higuchi *et al.*, (2012) and Mattox (2017) underline the benefits of advanced techniques like ultrasound guidance for cannulation while addressing cost and practicality. Complications, such as extravasation, highlighted by Cancer Research UK (2020), and factors like vein fragility add complexity to the practice. Research by Simin *et al.*, (2019) and Shintani *et al.*, (2022) identifies common complications such as phlebitis and cannula failure, indicating the broad scope of challenges associated with PIVC.

This study aims to synthesise local and international research to identify evidence-based guidelines and interventions to enhance nurses' proficiency in PIVC at AFH-KAAB. The study seeks to develop strategies to improve nurses' skills, patient outcomes, and safety by exploring educational backgrounds, training programs, and workplace support systems. This research is novel in its comprehensive approach to integrating existing knowledge with a specific focus on the unique context of AFH-KAAB. It offers tailored solutions to enhance practice in this critical patient care area.

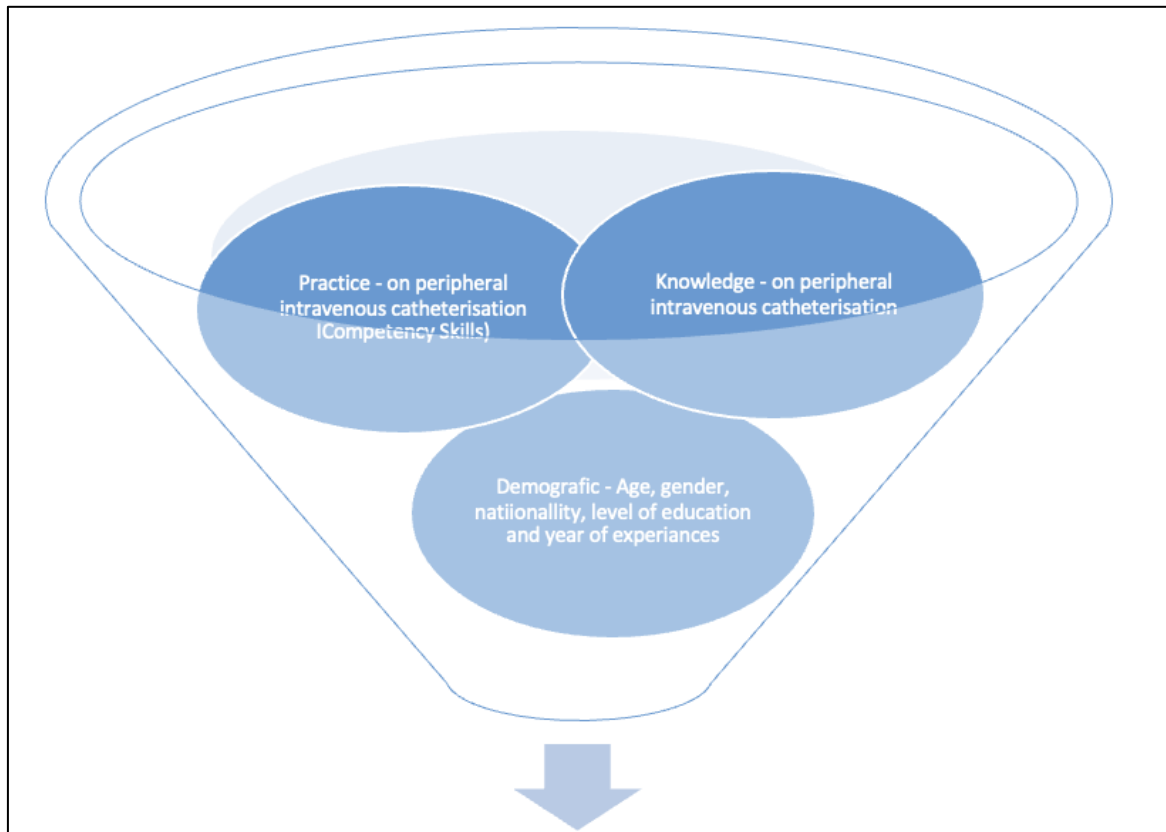


Figure 1: Conceptual Framework of Study

Improving Success Rates and Reducing Complications in Intravenous Cannulation: Knowledge and Practice on Peripheral Intravenous Catheterisation Among Nurses of AFH-KAAB In Dhahran, Saudi Arabia

The scope of this work involves a detailed literature review to understand current knowledge and identify research gaps. By doing so, the study sets out to develop and recommend effective practices and educational strategies for the nursing staff at AFH-KAAB. Ultimately, this research aspires to significantly enhance healthcare services significantly, ensuring safer and more effective use of peripheral intravenous lines in the hospital. This comprehensive examination of the literature and identification of best practices will form the foundation of a targeted intervention strategy to equip nurses at AFH-KAAB with the necessary knowledge and

skills to improve their performance and patient care outcomes in PIVC procedures.

EXPERIMENTAL SECTION/MATERIAL AND METHODS

This study employed a descriptive quantitative study design to provide a comprehensive and detailed understanding of the research topic, focusing on the knowledge and practices of peripheral intravenous catheterisation among nurses at the Armed Forces Hospital (AFH), King Abdul Aziz Airbase (KAAB) in Dhahran, Saudi Arabia.

The study site was the Armed Forces Hospital (AFH), King Abdul Aziz Airbase (KAAB) in Dhahran, Saudi Arabia.

A convenience sample comprising all nurses employed at AFH, Dhahran, Saudi Arabia, was used. The total population of nurses in the hospital is 290. Using the Rao Soft sample size calculator, with a 95% confidence level, a 5% margin of error, and a 50% response distribution, an ideal sample size of 166 staff members was determined. To account for an estimated attrition rate of 10%, 29 more participants were added, resulting in a total target sample size of 195 healthcare staff members.

- **Inclusion Criteria:** Nurses employed at the Armed Forces Hospital in Dhahran, Both male and female nurses, Nurses from various departments and units within the hospital, Nurses with different levels of experience and educational backgrounds and Nurses with yearly nursing competency in IV cannulation.
- **Exclusion Criteria:** Non-nursing staff members at the hospital (e.g., administrative staff, physicians), Nurses who are on leave or absent during the data collection period, Nurses who do not provide consent to participate in the study, Nurses with less than six months of experience at the hospital and Nurses without yearly nursing competency in IV cannulation.

A structured questionnaire adapted and adopted from a survey developed by Dr. Nor Haty Hassan from Malaysia was used to collect data on nurses' knowledge and clinical best practices in peripheral intravenous catheterisation. The survey included self-administered questionnaires and clinical practice observation and validation. Sections A and B Assessed demographic information and knowledge levels using dichotomous variables (Yes=1, No=2), and Section C Comprised skill-assessed competency practice assessment questions using a Practice (1) and Not Practice (2) scale.

The questionnaire was distributed via Google Forms, Nursing unit memo, and WhatsApp, ensuring participant confidentiality. Participants were thoroughly briefed on the study's purpose and nature, and informed consent was obtained from each respondent. Data was collected over four weeks, with the completion of the surveys monitored and responses securely stored to maintain privacy.

A preliminary phase with 196 participants was conducted to assess the full-scale study's feasibility,

duration, cost, and potential challenges. The pilot study ensured the methodologies were reliable and the survey instruments were valid. Data analysis was performed using IBM SPSS Statistics V29. Descriptive statistics (frequency, mean, standard deviation, percentages) were used to analyse demographic and research variables. Chart-based formats, following the APA 7th Edition guidelines, were used to present the findings. The study aimed to uncover patterns, trends, and associations between variables, focusing on improving success rates and reducing complications in intravenous cannulation. Insights from this analysis were intended to inform decision-making processes, policy developments, and further investigations.

Ethical approval was secured from the Research and Ethics Board at Armed Forces Hospital, Dhahran, Saudi Arabia (IRB approval no. AFHER-IRB-2024-002). Informed consent was obtained from department heads and participants, who were assured of their right to withdraw at any time. Strict confidentiality and data privacy measures were enforced throughout the study. Materials: Not applicable as the study did not involve chemical or drug administration, and not applicable as the study did not involve animal subjects.

RESULTS AND DISCUSSION

The study focused on analysing the knowledge and practices related to peripheral intravenous catheterisation (PIVC) among nurses at AFH-KAAB in Dhahran, Saudi Arabia, aiming to improve success rates and reduce complications associated with intravenous cannulation procedures. A sample size of 196 respondents was determined from a total population of 290 nurses, and data was collected through questionnaires covering demographic information, knowledge assessment, and practice evaluation. IBM SPSS Statistics V29 facilitated the analysis, employing descriptive statistics and chi-square tests to understand the relationships between socio-demographic variables and the nurses' knowledge and practices.

The study provided a comprehensive overview of the nurses' demographic profiles, including gender, age, nationality, education level, and clinical years of experience. The data indicated diverse backgrounds among the participants, which was critical in understanding the variability in knowledge and practice levels.

Table 1: Variables on Demographic Demographic Variables on Mean, frequency, percentage, and Std. Deviation (SD) N = 196

Variables	Categories	Frequency N	Percentage %	Mean	Std. Deviation
What is your Gender?	Male	9	4.6	1.8542	0.20984
	Female	187	95.4		
What is your age? (years)	25 – 35 years	77	39.3	2.1888	1.18108
	36 – 40 years	49	25.0		
	41 – 45 years	26	13.3		
	More than 46 years	44	22.4		
What is your nationality?	Saudi Arabia	29	14.8	3.2908	1.13324
	Malaysia	13	6.6		
	India	31	15.8		
	Philippines	118	60.2		
	Others	5	2.6		
Educational Background?	Diploma	35	17.9	1.8265	0.39290
	Bachelor	160	81.6		
	Master	1	0.5		
	PhD / Doctorate	0	0.0		
Clinical years experience in Nursing	More than 2 years	18	9.2	3.4082	0.96366
	More than 4 years	11	5.6		
	More than 6 years	40	20.4		
	More than 10 years	127	64.8		

Note. The findings are based on the provided variables, categories, frequencies, percentages, mean, and standard deviation values.

The findings highlight key insights about the participant demographics. A significant majority (95.4%) identify as female, while a small proportion (4.6%) identify as male, with minimal variation in gender distribution (mean = 1.8542, SD = 0.20984). The dominant age group is 25-35 years (39.3%), followed by 36-40 years (25.0%). The mean age value (2.1888) suggests a predominantly young demographic with moderate variation (SD = 1.18108). Most participants are from the Philippines (60.2%), with others from India (15.8%) and Saudi Arabia (14.8%). The mean nationality value (3.2908) indicates some diversity (SD = 1.13324). In terms of education, 81.6% have a bachelor's degree, 17.9% hold a diploma, and only one participant (0.5%) has a master's degree, with no PhDs (mean = 1.8265, SD

= 0.39290). Regarding clinical experience, 64.8% have over 10 years, and 20.4% have more than 6 years, with the average experience being between 6 and 10 years (mean = 3.4082, SD = 0.96366). Overall, participants are predominantly young, highly educated, experienced, mostly female, and mainly from the Philippines, India, or Saudi Arabia.

On Knowledge Assessment. The findings showed that, while a majority of nurses had a basic understanding of PIVC practices, there needed to be more knowledge regarding advanced techniques and complication management. Areas such as catheter rotation and recognising early signs of complications were particularly lacking.

Table 2: Variables on Knowledge Descriptive Statistic Variables on Knowledge

	Descriptive Statistics			
	YES N (%)	NO N (%)	Mean	Std. Deviation
Insertion of peripheral intravenous catheter is a “clean” procedure	156(79.6)	40(20.4)	1.2041	.40406
Handwashing and aseptic technique need to be done when palpating, inserting, replacing or dressing an intravascular device	192(98)	4(2)	1.0204	.14175
The peripheral catheter needs to be rotated within 72 to 92 hours of placement	145(74)	51(26)	1.2602	.43987
Dislodgement, oedema, and blockage of catheter are reasons for rotating catheter	179(91.3)	17(8.7)	1.0867	.28217
Veins in the ante-cubital fossa and lower extremities are to be used routinely in the insertion of peripheral intravenous catheter	98(50)	98(50)	1.5000	.50128
All fluid administration tubing and connectors should be replaced when the cannula is replaced	120(61.2)	76(38.8)	1.3878	.48849
Phlebitis, infiltration and extravasation are complications in peripheral intravenous catheter	195(99.5)	1(0.5)	1.0051	.07143
Phlebitis is a major problem leads by intravenous cannulation	189(96.4)	7(3.6)	1.0357	.18605
Documentation is not necessary in peripheral intravenous catheterisation	34(17.3)	162(82.7)	1.8265	.37962
Transparent, semi-permeable polyurethane dressing is used to stabilize catheter after insertion	188(95.9)	8(4.1)	1.0408	.19837

Note. Improving Success Rates and Reducing Complications in Intravenous Cannulation on Peripheral Intravenous Catheterisation Among Nurses on frequency, percentage and the distribution of responses (Yes/No) for each statement, along with the corresponding Mean, frequency, percentage and Std. Deviation (SD)

Regarding the perception of PIVC practices, nurses' responses indicated variability in their perceptions of PIVC guidelines. While many nurses acknowledged the importance of adhering to the guidelines, inconsistencies in implementation were observed, indicating a need for reinforcing the importance of standard protocols. The result shows all the lists for skills practice, showing nurses' practice.

Relationship between Socio-Demographic Variables and Knowledge. Chi-square tests revealed significant associations between specific socio-demographic characteristics and the knowledge of PIVC practices. Specifically, nurses with more years of clinical

experience and higher education levels exhibited greater knowledge. Among 196 healthcare participants, the study found that gender significantly influenced knowledge ($p = .049$), whereas age ($p = .097$) and education level ($p = .632$) did not show significant variance. Knowledge levels were consistent across different nationalities ($p = .834$). However, clinical experience was a significant factor, with those having more than 6 years of experience showing some gaps in knowledge ($p = .001$). These results highlight the need for ongoing education and evaluation to ensure high standards of handwashing and aseptic techniques in healthcare.

Table 3: Variables on Practice Descriptive Statistic Variables on Practice

	Skill Assessed	Competency	
		Practice N (%)	Not Practice N (%)
CQ1	Verify patient's identity using 2 identifiers.	196 (100%)	0 (0.0)
CQ2	Introduce yourself to patient	196 (100%)	0 (0.0)
CQ3	Explain procedure	196 (100%)	0 (0.0)
CQ4	Perform hand hygiene and wear clean glove.	196 (100%)	0 (0.0)
CQ5	Prepare necessary equipment, and clean tray	196 (100%)	0 (0.0)
CQ6	Select site for insertion of intravenous catheter by chosen vein. Example palpable, straight, non-pulsatile	196 (100%)	0 (0.0)
CQ7	CQ7. Apply tourniquet 5 – 15cm proximal to the selected vein, allowing vein to engorge with blood. Leave the tourniquet in place for no more than 3 minutes. Release tourniquet.	196 (100%)	0 (0.0)
CQ8	Select site for insertion of intravenous catheter	196 (100%)	0 (0.0)
CQ9	Perform hand hygiene	196 (100%)	0 (0.0)
CQ10	Wear non-sterile glove	196 (100%)	0 (0.0)
CQ11	Clear skin surface with anti-septic solution Disinfects site with 70% alcohol swab or 2% chlorhexidine in a back forth scrubbing motion. Allow antiseptic to dry, do not re-palpate site once clean. Reapply tourniquet.	196 (100%)	0 (0.0)
CQ12	Pull skin taut using thumb, apply traction around the skin of the chosen vein and insert the cannula (bevel side up)	196 (100%)	0 (0.0)
CQ13	Puncture skin with needle at 30 – 45 angles	196 (100%)	0 (0.0)
CQ14	Lower the angle, advance the cannula into the vein and observe for blood return (flashback)	196 (100%)	0 (0.0)
CQ15	Carefully and slowly advanced the cannula into the vein in short stages- after stage gradually withdraw a section of the needle until desired position obtained	196 (100%)	0 (0.0)
CQ16	Do NOT fully remove the needle from the patient until the cannula is fully inserted	196 (100%)	0 (0.0)
CQ17	Once the cannula if fully inserted, release the tourniquet and apply pressure to the vein above the cannula tip before completely removing the stylet, disposing immediately into the sharp's container.	196 (100%)	0 (0.0)
CQ18	Using ANTT, attach extension set and flush device with Normal saline and observe for pain or discomfort from the patient and swelling or leaking from the vein.	196 (100%)	0 (0.0)
CQ19	If no infusions are to be given, make sure extension ports are covered with needless connectors.	196 (100%)	0 (0.0)
CQ20	Connect to an appropriate IV administration set or injection cap/needless device	196 (100%)	0 (0.0)
CQ21	Commence infusion solution slowly and adjust flow rate as ordered	196 (100%)	0 (0.0)
CQ22	Observe insertion site for any swelling and blanching	196 (100%)	0 (0.0)
CQ23	Stabilize cannula with sterile transparent dressing ensuring the puncture site is covered completely	196 (100%)	0 (0.0)
CQ24	Loop the tubing on the patient's limb and secure with tape	196 (100%)	0 (0.0)
CQ25	Label the date and time of insertion and your initials	196 (100%)	0 (0.0)
CQ26	Ensure patient is comfortable and check frequently for impaired circulation distal to the infusion site	196 (100%)	0 (0.0)
CQ27	Remove gloves and Clear equipment disposes of supplies in appropriate waste bin and do hand hygiene	196 (100%)	0 (0.0)
CQ28	Document procedure in patient's medical records or nurses' reports Date and time of cannulation Cannula type, location of insertion site, solution used, solution for flushing Documenter problems or difficulties encountered during cannulation Type flow rate of infusion; name and dose of medication in the solution	196 (100%)	0 (0.0)
CQ29	Patient teaching and evidence of patient understanding	196 (100%)	0 (0.0)

Note, Improving Success Rates and Reducing Complications in Intravenous Cannulation on Peripheral Intravenous Catheterisation Among Nurses on frequency, percentage on Skill assessment competency practice.

The data indicates that all 196 clinical staff members assessed demonstrated exemplary competency

in inserting intravenous (IV) catheters, achieving 100% compliance across 29 competencies. This includes

essential practices such as verifying patient identity, introducing oneself, ensuring hand hygiene, and following proper antiseptic procedures, which are crucial for patient safety and infection prevention. Furthermore, the technical aspects of IV insertion and post-procedure management, including patient education and documentation, were executed flawlessly. These outstanding results reflect a profound understanding of the necessary procedures among the practitioners,

indicating a highly trained cohort with no discernible areas requiring improvement. Given that annual competency assessments are mandatory, it is essential to sustain this exemplary standard through continuous education and the establishment of feedback mechanisms, which will further enhance patient engagement strategies and ensure ongoing excellence within clinical practice.

Table 4: Inferential statistics

Table 4 (a): Inferential Statistics on the Insertion of Peripheral Intravenous catheter is a “clean” procedure

		Descriptive Statistics				
		Knowledge			Value	Asymptotic Significance (2-sided)
		N	Yes	No		
Gender	Male	9	7	2	.019 ^a	.890
	Female	187	149	38		
Age	25 – 35 years	77	60	17	3.170 ^a	.366
	36 – 40 years	49	41	8		
	41 – 45 years	26	23	3		
	More than 46 years	44	32	12		
Nationality	Saudi Arabia	29	24	5	5.658 ^a	.226
	Malaysia	13	12	1		
	Indian	31	27	4		
	Philippines	118	88	30		
	Others	5	5	0		
Education	Diploma	35	28	7	.265 ^a	.876
Background	Bachelor	160	127	33		
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	14	4	.965 ^a	.810
	More than 4 years	11	10	1		
	More than 6 years	40	32	8		
	More than 10 years	127	100	27		

Note. Inferential statistics (Chi-Square Test) of the Socio-Demographic Insertion of Peripheral Intravenous catheters is a “clean” procedure.

The study analysed the relationship between various socio-demographic factors and knowledge levels regarding the insertion of peripheral intravenous catheters using inferential statistics (Chi-Square Test). The sample included 187 females and 9 males, with gender showing no statistically significant difference in knowledge levels ($p = .890$). Age distribution showed similar results, with knowledge levels being consistent across age groups ($p = .366$). Participants represented

diverse nationalities, primarily from the Philippines, with no significant differences based on nationality ($p = .226$). Educational background also did not significantly influence knowledge levels ($p = .876$), and clinical experience had a negligible impact ($p = .810$). In conclusion, the analysis indicated that knowledge levels were relatively homogeneous among participants across gender, age, nationality, education, and clinical experience.

Table 4(b): Inferential statistics on socio-demographics on handwashing and aseptic techniques need to be done when palpating, inserting, replacing, or dressing an intravascular device

		Descriptive Statistics				
		Knowledge			Value	Asymptotic Significance (2-sided)
		N	Yes	No		
Gender	Male	9	8	1	3.882 ^a	.049
	Female	187	184	3		
Age	25 – 35 years	77	73	4	6.311 ^a	.097
	36 – 40 years	49	49	0		
	41 – 45 years	26	26	0		
	More than 46 years	44	44	0		
Nationality	Saudi Arabia	29	28	1	1.457 ^a	.834
	Malaysia	13	13	0		
	Indian	31	31	0		
	Philippines	118	115	3		
	Others	5	5	0		
Education	Diploma	35	35	0	.919 ^a	.632
Background	Bachelor	160	156	4	15.925 ^a	.001
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
	More than 2 years	18	18	0		
Clinical years experiences	More than 4 years	11	11	0	15.925 ^a	.001
	More than 6 years	40	36	4		
	More than 10 years	127	127	0		

Note. Descriptive statistics socio demographics on handwashing and aseptic techniques need to be done when palpating, inserting, replacing, or dressing an intravascular device.

The study analysed socio-demographic factors influencing knowledge of handwashing and aseptic techniques among 196 healthcare participants. Among them, 9 were male and 187 were female, with 8 males and 184 females knowledgeable in these techniques, showing a significant gender difference ($p = .049$). The age groups of 25-35, 36-40, 41-45, and over 46 years also largely demonstrated knowledge, with no significant age variance ($p = .097$). Nationalities included Saudi Arabia, Malaysia, India, the Philippines, and others, showing

uniform knowledge levels ($p = .834$). Education levels, ranging from diplomas to a single master's degree holder, showed consistent knowledge ($p = .632$). Clinical experience revealed that those with more than 6 years had 4 individuals lacking knowledge, showing significance ($p = .001$). This analysis highlights the need for ongoing education and evaluation of handwashing and aseptic techniques to ensure high healthcare standards across all demographic groups.

Table 4(c): Inferential Statistics (Chi-Square Test) of Socio-Demographic on the peripheral catheter needs to be rotated within 72 to 92 hours of placement

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			Yes	No		
Gender	Male	9	7	2	0.71 ^a	.790
	Female	187	138	49		
Age	25 – 35 years	77	55	22	2.132 ^a	.545
	36 – 40 years	49	37	12		
	41 – 45 years	26	22	4		
	More than 46 years	44	31	13		
Nationality	Saudi Arabia	29	20	9	5.870 ^a	.209
	Malaysia	13	12	1		
	Indian	31	20	11		
	Philippines	118	88	30		
	Others	5	5	0		
Education	Diploma	35	29	6	2.152 ^a	.341
Background	Bachelor	160	115	45	1.475 ^a	.688
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
	More than 2 years	18	15	3		
Clinical years experiences	More than 4 years	11	7	4	1.475 ^a	.688
	More than 6 years	40	29	11		
	More than 10 years	127	94	33		

Note that inferential Statistics (Chi-Square Test) of Socio-Demographics on the peripheral catheter needs to be rotated within 72 to 92 hours of placement.

The study investigates how socio-demographic factors affect knowledge about the necessity of rotating peripheral catheters within 72 to 92 hours of placement, utilizing inferential statistics (Chi-Square Test). It involved 196 participants (9 males and 187 females), and the results indicated no significant gender differences ($p = .790$), age-related differences ($p = .545$), nationality

impact ($p = .209$), educational background differences ($p = .341$), or correlations with clinical experience ($p = .688$). These findings suggest that socio-demographic factors do not significantly influence understanding of proper catheter rotation, highlighting the need for ongoing universal education to ensure adherence to best practices.

Table 4(d): Inferential Statistics (Chi-Square Test) of Socio-Demographic on Dislodgement, oedema, and blockage of the catheter are reasons for rotating catheter

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			No	No		
Gender	Male	9	9	0	.896 ^a	.344
	Female	187	170	17		
Age	25 – 35 years	77	72	5	2.740 ^a	.433
	36 – 40 years	49	44	5		
	41 – 45 years	26	25	1		
	More than 46 years	44	38	6		
Nationality	Saudi Arabia	29	25	4	7.610 ^a	.107
	Malaysia	13	11	2		
	Indian	31	26	5		
	Philippines	118	113	5		
	Others	5	4	1		
Education Background	Diploma	35	30	5	1.765 ^a	.414
	Bachelor	160	148	12		
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	15	3	2.566 ^a	.463
	More than 4 years	11	11	0		
	More than 6 years	40	37	3		
	More than 10 years	127	116	11		

Note. The descriptive statistics Chi-Square Test) The socio-demographic on “Dislodgement, oedema, and blockage of the catheter are reasons for rotating catheter”, provided in the table, offers insights into the distribution of participants based on various factors.

The study investigates how socio-demographic factors, such as gender, age, nationality, education, and clinical experience, influence knowledge regarding the need for catheter rotation due to dislodgement, oedema, and blockage, using the Chi-Square Test for analysis. Of the 196 participants (9 males and 187 females), there was no significant difference in knowledge based on gender

($p = .344$) or other factors, including age ($p = .433$), nationality ($p = .107$), education ($p = .414$), and clinical experience ($p = .463$). The findings suggest that socio-demographic factors do not significantly affect this understanding, emphasizing the need for universal educational programs to ensure consistent knowledge across diverse groups.

Table 4(e): Inferential Statistics (Chi-Square Test) Of Socio-Demographic on “Veins in the antecubital fossa and lower extremities are to be used routinely in the insertion of peripheral intravenous catheter”

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			Yes	No		
Gender	Male	9	5	4	.116 ^a	.733
	Female	187	93	94		
Age	25 – 35 years	77	41	36	3.108 ^a	.375
	36 – 40 years	49	27	22		
	41 – 45 years	26	13	13		
	More than 46 years	44	17	27		
Nationality	Saudi Arabia	29	17	12	4.969 ^a	.291
	Malaysia	13	8	5		
	Indian	31	12	19		
	Philippines	118	60	58		
	Others	5	1	4		
Education Background	Diploma	35	19	16	1.357 ^a	.507
	Bachelor	160	78	82		
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	9	9	2.444 ^{a7}	.486
	More than 4 years	11	8	3		
	More than 6 years	40	19	21		
	More than 10 years	127	62	65		

Note. The table provided presents descriptive statistics on the distribution of knowledge regarding the routine use of veins in the antecubital fossa and lower extremities for the insertion of peripheral intravenous catheters.

The study investigates socio-demographic factors affecting knowledge about using veins in the antecubital fossa and lower extremities for peripheral intravenous catheter insertion, employing the Chi-Square Test. Among 196 participants, including 9 males and 187 females, knowledge levels showed no significant gender differences ($p = .733$). Age groups revealed similar results, with no significant differences ($p = .375$). The participants' nationalities, education backgrounds, and

clinical experience levels also showed no significant impact on knowledge (nationality: $p = .291$; education: $p = .507$; clinical experience: $p = .486$). The findings suggest that gender, age, nationality, education, and clinical experience do not substantially influence understanding of this practice, underscoring the necessity for ongoing educational initiatives to enhance knowledge across all demographics.

Table 4(f): Inferential Statistics (Chi-Square Test) Of Socio-Demographics on “All fluid administration tubing and connectors should be replaced when the cannula is replaced”

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			Yes	No		
Gender	Male	9	8	1	3.041 ^a	.081
	Female	187	112	75		
Age	25 – 35 years	77	52	25	5.148 ^a	.161
	36 – 40 years	49	32	17		
	41 – 45 years	26	15	11		
	More than 46 years	44	21	23		
Nationality	Saudi Arabia	29	21	8	8.482 ^a	.075
	Malaysia	13	10	3		
	Indian	31	13	18		
	Philippines	118	72	46		
	Others	5	4	1		
Education Background	Diploma	35	20	15	.907 ^a	.635
	Bachelor	160	99	61		
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	13	5	1.828 ^a	.609
	More than 4 years	11	6	5		
	More than 6 years	40	22	18		
	More than 10 years	127	79	48		

Note. The table provides descriptive statistics on the distribution of knowledge regarding the All-fluid administration tubing and connectors should be replaced when the cannula is replaced”.

The study examines socio-demographic factors influencing knowledge about the replacement of fluid administration tubing and connectors when changing a cannula, utilising the Chi-Square Test. Among 196 participants—9 males and 187 females there was no significant knowledge difference based on gender, age, nationality, education, or clinical experience.

Specifically, knowledge levels were similar across various age groups and educational backgrounds, with no significant impact from factors such as nationality or clinical experience. The findings indicate a need for uniform and ongoing educational initiatives to enhance knowledge across all demographic groups.

Table 4(g): Inferential Statistics (Chi-Square Test) Of Socio-Demographic on Phlebitis, infiltration and extravasation are complications in peripheral intravenous catheter

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			Yes	No		
Gender	Male	9	9	0	.048 ^a	.826
	Female	187	186	1		
Age	25 – 35 years	77	76	1	1.553 ^a	.670
	36 – 40 years	49	49	0		
	41 – 45 years	26	26	0		
	More than 46 years	44	44	0		
Nationality	Saudi Arabia	29	29	0	.664 ^a	.956
	Malaysia	13	13	0		
	Indian	31	31	0		
	Philippines	118	117	1		
	Others	5	5	0		
Education Background	Diploma	35	35	0	.226 ^a	.893
	Bachelor	159	159	1		
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	18	0	3.920 ^a	.270
	More than 4 years	11	11	0		
	More than 6 years	39	39	1		
	More than 10 years	127	127	0		

Note. Based on the chi-square test results conducted on the socio-demographic variable "Gender" concerning the statement "Phlebitis, infiltration, and extravasation are complications in the peripheral intravenous catheter".

The study uses the Chi-Square Test to analyse how socio-demographic factors impact knowledge of complications related to peripheral intravenous catheters, including phlebitis, infiltration, and extravasation. Among 196 participants (9 males and 187 females), knowledge was nearly universal, with only one participant lacking awareness across gender, age (categorised into four groups), nationality (from

countries like Saudi Arabia, Malaysia, India, and the Philippines), education (diploma to master's), and clinical experience (ranging from over 2 to over 10 years). Statistical analyses showed no significant differences based on these factors, indicating the need for ongoing universal education to sustain high knowledge levels among all groups.

Table 4(h): Inferential Statistics (Chi-Square Test) of Socio-Demographics on Phlebitis is a major problem led by intravenous cannulation

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			Yes	No		
Gender	Male	9	9	0	.349 ^a	.554
	Female	187	180	7		
Age	25 – 35 years	77	74	3	.282 ^a	.963
	36 – 40 years	13	47	2		
	41 – 45 years	26	25	1		
	More than 46 years	44	43	1		
Nationality	Saudi Arabia	29	29	0	5.108 ^a	.276
	Malaysia	13	13	0		
	Indian	31	28	3		
	Philippines	118	114	4		
	Others	5	5	0		
Education Background	Diploma	35	33	2	.595 ^a	.742
	Bachelor	160	155	56		
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	18	0	1.822 ^a	.610
	More than 4 years	11	10	1		
	More than 6 years	40	39	1		
	More than 10 years	127	112	5		

Note. Based on the results of the chi-square test conducted on the socio-demographic variable "Gender" concerning the statement "Phlebitis is a major problem caused by intravenous cannulation,"

The study utilizes the Chi-Square Test to investigate the influence of socio-demographic factors—such as gender, age, nationality, education background, and clinical experience—on knowledge of phlebitis as a major issue stemming from intravenous cannulation. Among 196 participants, no significant differences were found across gender ($p = .554$), age ($p = .963$), nationality

($p = .276$), education ($p = .742$), or clinical experience ($p = .610$) regarding knowledge levels. The findings suggest that these socio-demographic factors do not significantly affect understanding of phlebitis, highlighting the importance of ongoing education to maintain knowledge consistency across different demographic groups.

Table 4(i): Inferential Statistics (Chi-Square Test) of Socio-Demographic on Documentation is not necessary in peripheral intravenous catheterisation

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			Yes	No		
Gender	Male	9	1	8	.256 ^a	.613
	Female	187	33	154		
Age	25 – 35 years	77	17	60	3.854 ^a	.278
	36 – 40 years	49	5	44		
	41 – 45 years	26	3	23		
	More than 46 years	44	9	35		
Nationality	Saudi Arabia	29	11	18	12.591 ^a	.013
	Malaysia	13	0	13		
	Indian	31	6	25		
	Philippines	118	16	102		
	Others	5	1	4		
Education Background	Diploma	35	10	25	3.900 ^a	.142
	Bachelor	160	24	136		
	Master	1	0	1		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	9	9	15.641 ^a	.001
	More than 4 years	11	1	10		
	More than 6 years	40	4	36		
	More than 10 years	127	20	107		

Note. Based on the results of the chi-square test conducted on the socio-demographic variable "Gender" concerning the statement "Documentation is not necessary for peripheral intravenous catheterisation".

The study employs the Chi-Square Test to analyse how socio-demographic factors influence beliefs about the necessity of documentation for peripheral intravenous catheterisation. Among 196 participants, the results show no significant gender, age, or educational differences in beliefs ($p > .05$). However, significant differences were found based on nationality ($p = .013$)

and clinical experience ($p = .001$), indicating that these factors affect perceptions of documentation's necessity. The findings suggest a need for culturally sensitive and experience-based educational programs to foster a consistent understanding of documentation's importance across all demographic groups.

Table 4(j): Inferential Statistics (Chi-Square Test) Of Socio-Demographic on Transparent, semi-permeable polyurethane dressing is used to stabilise catheter after insertion

		Descriptive Statistics				
		N	Knowledge		Value	Asymptotic Significance (2-sided)
			Yes	No		
Gender	Male	9	9	0	.401 ^a	.526
	Female	187	179	8		
Age	25 – 35 years	77	74	3	.035 ^a	.998
	36 – 40 years	49	47	2		
	41 – 45 years	26	25	1		
	More than 46 years	44	42	2		
Nationality	Saudi Arabia	29	29	0	2.332 ^a	.675
	Malaysia	13	12	1		
	Indian	31	29	2		
	Philippines	118	113	5		
	Others	5	5	0		
Education Background	Diploma	35	34	1	.212 ^a	.900
	Bachelor	160	153	7		
	Master	1	1	0		
	PhD / Doctorate	0	0	0		
Clinical years experiences	More than 2 years	18	18	0	1.861 ^a	.602
	More than 4 years	11	10	1		
	More than 6 years	40	39	1		
	More than 10 years	127	121	6		

Note, based on the chi-square test results conducted on the socio-demographic variable "Gender" in relation to the statement "Transparent, semi-permeable polyurethane dressing is used to stabilise the catheter after insertion".

The study utilises the Chi-Square Test to assess the effect of socio-demographic factors on gender, age, nationality, education background, and clinical experience on knowledge regarding the use of a transparent, semi-permeable polyurethane dressing for catheter stabilisation. Out of 196 participants (9 males and 187 females), knowledge was high across groups,

with no significant differences found in gender ($p = .526$), age ($p = .998$), nationality ($p = .675$), education ($p = .900$), or clinical experience ($p = .602$). The findings suggest that these socio-demographic factors do not significantly influence knowledge levels, highlighting the necessity for ongoing education to sustain high knowledge among all demographic groups.

high compliance with standard operating procedures and effective training programs.

However, significant gender differences in knowledge ($p = .049$) and a notable impact of clinical experience ($p = .001$) were found, with more experienced nurses demonstrating higher competency levels. There were also significant differences based on nationality ($p = .013$) and clinical experience concerning the belief that documentation is unnecessary for PIVC. These gaps underscore the need for targeted, culturally sensitive educational programs. Although general agreement existed on the importance of handwashing and aseptic techniques, opinions varied on procedural elements such as catheter rotation, vein selection, and the replacement of fluid administration tubing, highlighting areas requiring further standardisation.

Key findings

Future research should explore developing and implementing targeted training programs to enhance nurses' competencies in PIVC. Evaluating the impact of these interventions on clinical outcomes, such as success and complication rates, would provide valuable insights. Additionally, longitudinal studies could assess how continuous professional development affects PIVC practices. Further studies might also investigate patient outcomes and satisfaction in implementing improved PIVC practices. Understanding patient perspectives could offer additional dimensions to the analysis and highlight areas for further improvement.

Outcomes and Recommendations

Overall, this research emphasises the importance of continuous education and standardised training in enhancing the knowledge and practices of nurses in PIVC. Addressing the identified gaps through such initiatives could significantly improve patient care quality and outcomes, ultimately leading to better success rates and reduced complications in intravenous cannulation procedures. The evidence-based recommendations from this study can significantly impact patient safety and care quality at AFH-KAAB and in similar healthcare settings globally. Future research should build on these findings, incorporating more extensive and diverse samples, longitudinal designs, and objective measures to provide a more comprehensive understanding of PIVC practices. This continuous commitment to professional development and standardisation of nursing practices is essential for advancing the overall standards of healthcare practice, enhancing nursing competence, and improving patient care.

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