Assessment of Peripheral Intravenous Catheter (PIVC) Knowledge and Perceptions of Phlebitis Risk Factors among Nurses in a University Hospital in Selangor

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ABSTRACT

Background: Phlebitis is a frequently occurring complication in the peripheral venous catheterization of hospitalized patients. Knowledge and perception in regard to compliance with the guidelines are required for all nurses involved in the insertion and care of peripheral intravascular catheters (PIVC). **Objective:** The aim of this study is to assess the knowledge of PIVC care among nurses and their perceptions of risk factors for phlebitis in a university hospital located in Selangor, Malaysia. **Methods:** The design used for this research is quantitative and non-experimental. It was conducted using a cross-sectional study design involving knowledge and perceptions. In conjunction with that, a convenience sampling approach and unrestricted self-selected surveys of 170 hospital nurses were conducted at a university hospital in Selangor. **Results:** Over 58.8% of the nurses demonstrated a very high level of knowledge, while approximately 47.1% exhibited a good perception of phlebitis risk. Notably, a statistically significant correlation was observed between knowledge level and factors such as years of clinical experience, PIVC training, and the frequency of PIVC handling ($p<0.05$). In terms of perception regarding phlebitis risk factors, a noteworthy relationship was found with years of clinical experience, the workplace, PIVC training, and the frequency of PIVC handling, all of which achieved statistical significance ($p<0.05$). **Conclusion:** Specific measures should be taken to improve nurses' understanding of PIVC and their awareness of phlebitis risk factors. Nurses are entrusted with various responsibilities in the course of intravenous treatment, which encompass initiating, monitoring, maintaining, and discontinuing intravenous infusions. Therefore, nursing staff must be proficient in all facets of intravenous care, including identifying and preventing phlebitis.

Keywords: Knowledge; Perceptions; Peripheral Intravenous Catheter (PIIV) Cannulation; Phlebitis

INTRODUCTION

A peripheral intravenous catheter (PIVC) is widely used in clinical practice as it benefits the patient and saves lives by allowing rapid absorption of medication and fluids. PIVC is venous access that allows the administration of medication, fluids, parenteral nutrition, chemotherapy, blood products, and blood sampling (Arbee & Mohd Ghazali, 2013).

However, insertion of PIVC can cause infectious complications such as phlebitis, infection, extravasation, skin trauma, or non-infectious complications such as catheter obstruction, accidental removal, and pain (Abolfotouh *et al.*, 2014; Kashiura *et al.*, 2022). A study in ICU showed various factors are involved in the development of phlebitis caused by PIVCs in critically ill patients, including institutional, patient, catheter, and drug-induced factors, indicating the need for appropriate device selection or models of care (Yasuda *et al.*, 2022). The complications of PIVC include extravasation, infiltration, blockage, dislodgement, and early access

impairment in up to 69% of hospitalized patients (Ray-Barruel *et al.*, 2019). A study conducted by Daud *et al.* (2018) in one of the hospitals in East Coast Malaysia reported that the incidence of phlebitis in patients admitted with PIVC was 36.1%.

Nurses have a significant role in interrupting the transmission of infections and preventing complications (Osti *et al.*, 2017). Nurses must adhere to the guidelines and perform nursing care correctly during the insertion procedure by monitoring and assessing PIVC sites (Arbee & Mohd Ghazali, 2013). During PIVC insertion, the nurses must puncture the skin and place the catheters into the vein. Depending on the patient's needs, various sizes of vascular access devices and PIVC placements exist. The insertion procedure must be performed correctly to prevent bacterial phlebitis. Then, the nurses should know about the medication that will be infused into the PIVC. High concentrations and acidic medications can cause chemical phlebitis. O'Grady *et al.* (2011) highlighted that guidelines from the Center for Disease Control proposed that healthcare institutions do a regular assessment of knowledge and care of PIVC to avoid infection.

A recent local study indicated that just 56.8% of the participants reported possessing adequate knowledge about phlebitis risk factors, including drug acidity, osmolarity, and concentration during infusion (Ying *et al.*, 2020). But other studies showed that nurses should be trained about the risk factors for phlebitis, as most nurses have only a moderate level of knowledge (Shaikh *et al.*, 2023; Bibi *et al.*, 2023). Hence, this research was undertaken to assess the level of nurses' understanding regarding PIVC care and their perceptions of phlebitis risk factors at a university hospital in Selangor. It is hoped that the final results at the end of this study will be optimistic about developing better and more effective programs that are most likely to help reduce the incidence of PIVC complications and improve nursing care to the next level.

METHODOLOGY

Research Methodology, Study Location, and Targeted Study

The research employed a quantitative and cross-sectional study design and was carried out at the Universiti Teknologi MARA (UiTM) Hospital in Selangor. It is located at Jalan Hospital, 47000 Sungai Buloh. The target population of this study was among nurses at UiTM Hospital in Selangor. The overall population of nurses in UiTM Hospital is about 200, including nurses from the Intensive Care Unit (ICU), Operation Theatre (OT), Cardiac Care Unit (CCU), Medical, and Surgical Wards.

Determination of Sample Size, Inclusion Criteria, and Exclusion Criteria

The sample size calculation was determined as calculated by Raosoft Software with a margin of 5% and a confidence level of 95%. The estimated sample size was 170 (n=170). The eligibility criteria are registered staff nurses at UiTM Hospital, Selangor. Besides that, the participants can also understand and communicate in English. Respondents, staff nurses on long leave, nurses on confinement leave, nurses with less than six months of working experience in the clinical area, and nurses not dealing with insertion, care, and maintenance were excluded from the study.

Data Collection Process

The participants were provided with comprehensive information and were capable of giving informed consent for their participation. Additionally, strict measures were taken to ensure the anonymity of participant information, preventing the identification of the sources.

Data collection occurred over three months, from February to August 2021. The study employed a convenience sampling technique, inviting university hospital nurses who met the eligibility criteria to participate via an online self-administered questionnaire.

Instrumentation and Pilot Test

The survey instruments were structured into three sections, with Section A comprising socio-demographic information and encompassing five items. This includes total years of clinical experience, working area, educational level, whether the nurses have attended PIVC training before, and frequency of handling or inserting PIVC.

Section B pertained to assessing knowledge regarding the care and maintenance of peripheral intravenous

catheters and consisted of 17 questions. This knowledge assessment instrument for peripheral intravenous catheter care and maintenance was adapted from Khairunniza *et al.* (2019). The questions were rated on a scale where 1 denoted 'true' and 0 represented 'False/Don't Know.' These 17 questions employed a nominal scale format with response options such as 'Yes,' 'No,' and 'I do not know." Knowledge levels are measured using McDonald's criteria for learning outcomes, such as those used in Khairunniza's study (2019), and categorized as very low knowledge. < 60% (answered correctly < 10 questions), low knowledge: 60% - 69% (answered correctly 11 questions), moderate knowledge: 70% - 79% (answered correctly 12 or 13 questions), high knowledge: 80% - 89% (answered correctly 14 or 15 questions), and very high knowledge: 90% - 100% (answered correctly 16 or 17 questions).

Section C encompasses inquiries related to the perceptions of risk factors for phlebitis among nurses in Malaysia. The questionnaire was adopted from Ying *et al.* (2020). This part contained 20 closed-ended questions. Participants were asked to answer the questions with "yes, "no, or "not sure". The optional (not sure) choice is intended to prevent the need for unnecessary yes/no responses. Each correct answer is awarded one point, and there are no points for each incorrect or uncertain answer. Perception levels were assessed by interpreting the percentage scores according to Ying's (2020) classification, which categorized them as follows: Poor (<50%), Moderate (50% to <80%), and Good $\geq 80\%$. In line with previous research, Cronbach's alpha value for knowledge in this study was found to be 0.829, as reported by Khairunniza *et al.* (2019), while for perception, as indicated in Ying *et al.*'s (2020) research, it was 0.830. However, it is worth noting that a value of 0.8 or higher was deemed acceptable.

Prior to the actual study, a pilot study was conducted involving 30 registered staff nurses, and it revealed that the Cronbach's Alpha coefficient for the instruments reached an acceptable level of 0.829. Consequently, participants in the pilot study were not included in the final study.

Data Analysis

The collected data underwent analysis using IBM SPSS Statistics Version 25. The analysis included descriptive and inferential statistics, specifically employing the Chi-square and Fisher Exact tests. A significance threshold of less than 0.05 was adopted to determine the rejection of the null hypothesis.

Ethical Considerations

The present study received ethical approval from Research Ethics Committee of Universiti Teknologi MARA (UiTM), Malaysia on 24th February 2021 with reference number REC/02/2021 (UG/MR/93).

RESULTS

A total of 170 questionnaires were distributed via Google Forms, and notably, all 170 questionnaires were completed and returned by the respondents, resulting in a response rate of approximately 100% (n=170).

Distribution of Demographic Data among Nurses in a University Hospital in Selangor

As documented, Table 1 presents the demographic information of the participants. The results indicated that when it came to years of clinical experience, a significant majority of respondents (72.4%, n=123) were nurses with less than a decade of experience. In comparison, 27.6% (n=47) were nurses with over a decade of experience. This showed the imbalance in the number of nurse respondents among the university hospital staff in Selangor. Overall, 68.2% (n=116) of all respondents reported they were from the critical area, while 31.8% (n=54) reported they were from the general ward during the survey. The study covered two levels of education among nurses: a diploma in nursing and a degree in nursing. Also, it showed the number of respondents with a diploma in nursing is higher, which is 81.8% (n=139), compared to nurses with a nursing degree, which is 18.2% (n=31).

In this study, the findings for the PIVC training showed 60% (n=102) of the nurses who had attended the training were, while 40% (n=68) reported they were the nurses who did not have a chance to attend the PIVC training at the time of the survey. Lastly, the frequency of handling PIVC showed the data, as the daily reported higher percentage was 52.9% (n=90), followed by once a week 33.5% (n=57), and lastly once a month 13.5% (n=23) in nurses frequency of handling PIVC. Handling PIVC means the nurses are involved with PIVC management, such as inserting, administering, caring for, and stopping the intravenous infusions.

Table 1: Demographic Data (n=170)

Variable	Frequency (n)	Percentage (%)
Years of clinical experience		
1 -10 years	123	72.4
11 years and above	47	27.6
Working area		
Critical Area (ICU, OT, and CCU)	116	68.2
General Ward (medical AndSurgical Wards)	54	31.8
Educational Level		
Diploma in Nursing	139	81.8
Degree in Nursing	31	18.2
PIVC Training		
Yes	102	60
No	68	40
Frequency Handling PIVC		
Daily	90	52.9
Once a week	57	33.5
Once a month	23	13.5

Knowledge level of the Peripheral Intravascular Catheter (PIVC) care among nurses in a University Hospital in Selangor

Table 2 below shows the frequency and percentage of nurses in each knowledge level category. The mean knowledge score was calculated and expressed on a scale of 100 (M=4.49, SD = 0.664). More than half of the nurses at Hospital University have very high knowledge regarding PIVC, with a percentage score of 58.8% (n=100). The rest of the nurses have high and moderate knowledge (n=54, 31.8%) and (n=16, 9.4%), respectively. In contrast, none had very low or low knowledge (n=0, 0%).

Table 2: Knowledge Level Regarding Peripheral Intravenous Catheter (PIVC) (n=170)

Knowledge level	Frequency (n)	Percentage (%)
Total knowledge score (Mean ± SD)	(4.49 ± 0.664)	
Very low knowledge	0	0
Low knowledge	0	0
Moderate knowledge	16	9.4
High knowledge	54	31.8
Very high knowledge	100	58.8

Table 3 reveals that the highest knowledge scores regarding PIVC were achieved in response to the initial questions. All participants, accounting for 100% (n=170), correctly acknowledged the importance of introducing themselves to the patient, verifying their identity, and securing verbal consent before the procedure. The second-highest knowledge score was observed in response to the question about phlebitis, which is the most recognizable infection associated with intravenous cannulation. Remarkably, about 99.4% (n=169) of the participants demonstrated their ability to identify this common infection related to PIVC. Furthermore, 98.8% (n=168) of respondents were well-informed about the crucial role of hand hygiene in reducing infection risks. Additionally, they were aware that the factors influencing catheter selection encompassed the catheterization's purpose and the targeted vein's size.

In terms of infection prevention, a significant majority of respondents (91.8%, n=156) recognized that

repeated attempts to insert an intravenous cannula increased phlebitis risk, thrombosis, and infections related to the cannula. They were also informed about the importance of switching to a new cannula if the initial attempt failed. Regarding vein selection for PIVC, 86.5% (n=147) were aware that cephalic and basilic veins were commonly used. Additionally, 85.3% (n=145) of respondents knew that 18G cannulas were typical and suitable for adult peripheral venous cannulation.

On the other hand, the two lowest knowledge level scores of PIVC were associated with removing the cannula within 72 hours after insertion, regardless of infection presence, with 83.5% (n=142) correctly identifying this practice. Furthermore, 75.9% (n=129) of respondents were unaware that Staphylococcus aureus was the most commonly identified organism in cases of infected intravenous catheters, representing the lowest-scoring item.

Table 3: Items with the Highest and Lowest Percentage of Nurses Answered Correctly on the Nurse's Knowledge of the Peripheral Intravenous Catheter (PIVC) Questionnaire (n=170)

Items (Answer)	Frequency (n)	Percentage (%)
No 1: Self-introduction to the patient and clarification of the patient's identity is important before performing intravenous cannulation.	170	100
No 2: The patient should be informed of the procedure, and verbal consent should be obtained.	170	100
No 7: Phlebitis is the most identifiable infection related to intravenous cannulation.	169	99.4
No 4: Factors that influence the choice of the cannula are the purpose of cannulation and the size of the vein to be cannulated.	168	98.8
No 8: Hand hygiene before performing intravenous cannula insertion is important to reduce the risk of infection.	168	98.8
No 14: Usage of transparent dressing will help in recognizing early signs and symptoms of infection.	164	96.5
No 9: Maintaining an aseptic technique during the insertion of an intravenous cannula helps in reducing the risk of infection.	162	95.3
No 10: Wearing gloves during insertion of the intravenous cannula is advisable.	162	95.3
No 12: Multiple attempts of intravenous cannulation increased the risk of phlebitis, thrombosis, and cannula-related infection.	156	91.8
No 13: Change to a new cannula if the first attempt of intravenous cannulation failed	156	91.8
No 17: Patient education on t he care of intravenous cannula helps in reducing the risk of infection.	156	91.8
No 15: Removing the intravenous cannula immediately if it is not in use will help to reduce the risk of infection.	155	91.2
No 5: Cephalic and basilic veins on the forearm are frequently used in intravenous cannulation.	147	86.5
No 11: Skin preparation of the insertion site is required before intravenous cannulation is performed.	147	86.5
No 3: 18G cannula is suitable to be used for adult peripheral intravenous cannulation.	145	85.3
No 6: Peripheral intravenous cannula cannot be left in situ for more than 72 hours, irrespective of the presence of infection.	142	83.5
No 16: Staphylococcus aureus is the most common organism identified with an infected intravenous catheter.	129	75.9

Perceptions Level of Phlebitis Risk Factors among Nurses at a University Hospital in Selangor

Displayed in Table 4 is the prevalence of nurses' perceptions regarding risk factors for phlebitis in a Selangor University hospital. As indicated by the assessment criteria, nurses were considered to have a favorable

understanding of phlebitis risk factors when they provided correct answers to at least 80% of the questions.

The mean of the perception score was calculated and expressed on a scale of 100 (M=2.38, SD=0.644). Only (n=80, 47.1%) of the nurses have a good perception of the risk factor of phlebitis. The rest of the nurses have moderate and poor perceptions of the risk of phlebitis (n=75, 44.1%) and (n=15, 8.8%), respectively.

Table 4: Perceptions Level of Risk Factors for Phlebitis (n=170)

Knowledge level	Frequency (n)	Percentage (%)
Total perception score (Mean ± SD)	(2.38 ± 0.664)	
Poor	15	8.8
Moderate	75	44.1
Good	80	47.1

Table 5 below illustrates the percentages of correct responses, ranked from the highest to the lowest, regarding nurses' perceptions of risk factors for phlebitis. Most nurses (n=167, 98.2%) concurred that conducting daily assessments of cannulation sites to detect signs of phlebitis reduces the risk of its occurrence. Similarly, most respondents (n=161, 94.7%) recognized that maintaining hand hygiene and employing aseptic techniques during care of the cannulated site decreases the risk of phlebitis. Furthermore, a substantial portion of the participants (n=152, 89.4%) acknowledged that leaving the cannula in place for more than 96 hours (4 days) increases the risk of phlebitis.

Additionally, while preparing the cannulation site, a majority (n=140, 82.3%) of nurses believed that skin preparation with 2% chlorhexidine in alcohol before cannulation reduces the risk of phlebitis. When it came to inserting a PIVC in a patient with an ongoing infection, a significant proportion (n=139, 81.7%) of the nurses believed that it heightened the risk of phlebitis. Furthermore, (n=133, 78.2%) respondents perceived that cannulating a patient with diabetes mellitus increased the risk of phlebitis.

Regarding the choice of cannula size, half of the respondents (n=85, 50%) agreed that using a 16G cannula increased phlebitis risk. Respondents (n=82, 48.2%) also agreed that replacement of the cannula more frequently than every 72-96 hours (3-4 days) increased phlebitis risk. However, only (n=74, 43.5%) of the respondents were aware that infusing alkaline drugs increased the phlebitis risk.

Table 5: The Items with the Highest and the Lowest Percentage of Nurses Responded on the Perception of the Risk Factors of Phlebitis (n=170)

Items	Frequency (n)	Percentage (%)
No 20: I think that daily assessment of the cannulation site for signs of phlebitis decreases the risk for phlebitis	167	98.2
No 15: I think that maintaining hand hygiene and aseptic techniques during care of the cannulated site decreases the risk for phlebitis	161	94.7
No 10: I think that leaving the cannula in situ for more than 96 hours (4 days) increases the risk for phlebitis	152	89.4
No 8: I think that trauma to the vein during cannula insertion increases the risk for phlebitis	148	87.0
No 13: I think that the proper securement of the cannula decreases the risk for phlebitis	148	87.0
No 16: I think that a soiled dressing increases the risk for phlebitis	146	85.8
No 4: I think that the infusion of drugs that have a high concentration increases the risk for phlebitis	144	84.7

No 5: I think that the risk of phlebitis increases if flushing is not done after the administration of medication	143	84.1
No 14: I think that preparation of the skin with 2% of chlorhexidine in alcohol before cannulating decreases the risk for phlebitis	140	82.3
No 19: I think that cannulation for a patient with ongoinginfection increases the risk for phlebitis	139	81.7
No 18: I think that cannulation for a patient with diabetes mellitus increases the risk for phlebitis	133	78.2
No 7: I think that the administration of large volumes of crystalloids and colloids at high flow rates increases the risk for phlebitis	126	74.1
No 17: I think that cannulation for a patient with the age of 60 or above increases the risk for phlebitis	126	74.1
No 6: I think that the risk for phlebitis increases if flushing is not done in between each administration of medications	121	71.1
No 3: I think that the infusion of drugs that have a high osmolarity increases the risk for phlebitis	117	68.8
No 1: I think that the infusion of drugs that are acidic increases the risk for phlebitis	114	67.0
No 11: I think that insertion of the cannula into the antecubital fossa increases the risk for phlebitis.	97	57.0
No 12: I think that the use of 16G cannula increases the risk for phlebitis	85	50.0
No 9: I think that replacing the cannula more frequently than every 72 -96 hours (3−4 days) increases the risk for phlebitis	82	48.2
No 2: I think that the infusion of drugs that are alkaline increases the risk for phlebitis	74	43.5

Relationship Between Knowledge of Pivc and Demographic Data Among Nurses of a University Hospital in Selangor

Table 6 below presents the relationship between the level of knowledge of PIVC and demographic data among nurses of a university hospital in Selangor. The study was done on the nurses in the university hospital (n=170). Chi-Square and Fisher's Exact tests revealed that the knowledge level was linked to three of the five demographic data variables.

Years of clinical experience showed a significant association with the level of knowledge with $\chi2 = 8.433$, p-value <0.05. The nurses with experience of 11 years and above (n=29, 61.7%) have a very high knowledge level compared to the nurses with clinical experience of 10 years and below (n=71, 57.7%).

Next, there is a significant association in the training of PIVC towards nurses' level of knowledge with $\chi2 = 22.784$, p-value <0.05. The nurses who received PIVC training showed a higher percentage of a good level of knowledge (n=75, 73.5%) compared to those who did not attend the PIVC training before (n=25, 36.8%).

Furthermore, frequency in handling PIVC showed a significant association with the nurses' knowledge level with $\chi2 = 25.566$, p-value <0.05. Nurses who frequently handle PIVC have a very high level of knowledge of PIVC (n=68, 75.6%) compared to other groups.

Meanwhile, there was no association between knowledge level with working area and educational level at p-value >0.05.

Table 6: The Relationship Between Knowledge of PIVC and Demographic Data (n=170)

Variables	Moderate Knowledge n (%)	High Knowledge n (%)	Very High Knowledge n (%)	Total % (n=170) N (%)	Test Statistic	*p*-value
Years Of Clinical Experience [b]						
1 - 10 Years	16 (13.0)	36 (29.3)	71 (57.7)	123 (72.4)	8.433	0.014*
11 Years And Above	0 (0.0)	18 (38.3)	29 (61.7)	47 (27.6)		
Working Area [b]						
Critical Care Area	12 (10.3)	43 (37.1	61 (52.6)	116 (68.2)	5.912	0.051
General Ward	0 (0.0)	11 (20.4)	39 (72.2)	54 (31.8)		
Educational Level [b]						
Diploma In Nursing	13 (9.4)	45 (32.4)	81 (58.3)	139 (81.8)	0.196	0.955
Degree In Nursing	0 (0.0)	9 (29.0)	19 (61.3)	31 (18.2)		
PIVC Training [a]						
Yes	6 (5.9)	21 (20.6)	75 (73.5)	102 (60)	22.784	0.001*
No	10 (14.7)	33 (48.5)	25 (36.8)	68 (40)		
Frequency Of Handling PIVC [b]						
Daily	0 (0.0)	19 (21.1)	68 (75.6)	90 (52.9)	25.566	0.001*
Once A Week	11 (19.3)	25 (43.9)	21 (36.8	57 (33.5)		
Once A Month	0 (0.0)	10 (43.5)	11 (47.8)	23 (13.5)		

*Note: *significant at p<0.05*

a Chi-square was employed to assess group proportions in categorical data.

b Fisher's Exact test was utilized for comparing group proportions in categorical data.

Relationship between Perception of Risk Factors for PIVC and Demographic Data among Nurses of a University Hospital in Selangor

Table 7 displays the correlation between nurses' perception levels of phlebitis risk factors and their demographic information at a Selangor University hospital. The research included 170 nurses from the hospital (n=170). A Fisher's Exact test revealed a significant association between the perception level and four out of five demographic variables.

Years of clinical experience showed a significant association with the level of perception with $\chi2 = 15.375$, *p*-value <0.05. The nurses with clinical experience of 1 to 10 years (n=64, 52%) have a good level of perception compared to the nurses with clinical experience of 11 years and above (n=16, 34%). The other demographic data with a significant association with the level of perception is the working area, which is $\chi2 = 8,045$, *p*-value <0.05. Nurses from the general ward had a higher percentage of the good level of perceptions (n=34, 63%) compared to nurses from the critical care area (n=46, 39%).

Next, there is a significant association in the training of PIVC towards nurses' level of perception with $\chi2 = 17.141$, *p*-value <0.05. The nurses who received PIVC training showed a higher percentage of a good level of perception (n=60, 58.8%) compared to those who did not attend the PIVC training before (n=20, 29.4%). Furthermore, frequency in handling PIVC also showed a significant association with the level of perception among the nurses with $\chi2 = 34.137$, *p*-value <0.05. Nurses who frequently handle PIVC have a good level of perception towards the risk of phlebitis (n=56, 62.2%).

Meanwhile, educational level showed no significant association with the level of perception towards risk factors of phlebitis with $\chi2 = 3.871$, p-value >0.05.

Table 7: Relationship between the Level of Perception Level of Phlebitis Risk Factors and Demographic Data (n=170)

Variables	Poor n (%)	Moderate n (%)	Good n (%)	Total % (n=170) n (%)	Test Statistic	p-value
Years of Clinical Experience						
1 – 10 Years	15 (12.2)	44 (35.8)	64 (52.0)	123 (72.4)	15.375	0.001*
11 Years And Above	0 (0.0)	31 (66.0)	16 (34.0)	47 (27.6)		
Working Area						
Critical Care Area	13 (11.2)	57 (49.1)	46 (39.7)	116 (68.2)	8.045	0.015*
General Ward	2 (3.7)	18 (33.3)	34 (63.0)	54 (31.8)		
Education Level						
Diploma in Nursing	15 (10.8)	60 (43.2)	64 (46.0)	139 (81.7)	3.871	0.149
Degree in Nursing	0 (0.0)	15 (48.4)	16 (51.6)	31 (18.2)		
PIVC Training						
Yes	4 (3.9)	38 (37.3)	60 (58.8)	102 (60)	17.141	0.001*
No	11 (16.2)	37 (54.4)	20 (29.4)	68 (40)		
Frequency Of Handling PIVC						
Daily	1 (1.1)	33 (36.7)	56 (62.2)	90 (52.9)	34.137	0.001*
Once a Week	14 (24.6)	27 (47.4)	16 (28.1)	57 (33.5)		
Once a Month	0 (0.0)	15 (65.2)	8 (34.8)	23 (13.5)		

*Note: *significant at p<0.05*
Fisher's Exact test was utilized for comparing group proportions in categorical data.

DISCUSSION

Assessment of nurses' knowledge and perception levels regarding Peripheral Intravenous Catheter (PIVC) care and phlebitis risk factors in a University Hospital in Selangor.

The results of this study demonstrate that nurses possess a substantial level of knowledge regarding the care of peripheral intravenous catheters within the hospital. The data reveal that most nurses exhibited a very high level of knowledge, while a smaller proportion displayed a moderate level of knowledge. These findings align with a recent study conducted by Hossain *et al.* (2016) at a hospital in Dhaka city, which reported that a significant majority of nurses (49.7%) at a general hospital had good knowledge, with only a tiny percentage (3.10%) demonstrating poor knowledge.

Moreover, the present study's results highlight that most nurses scored highly (100%) in self-introduction, patient clarification, and obtaining verbal consent before initiating IV cannulation procedures. This aligns with Timby and Smith's (2014) recommendation that explanations should be clear, concise, and informative to alleviate patient anxiety before procedures.

In contrast, the study's findings regarding nurses' perceptions of phlebitis risk factors indicate that approximately 47.1% possessed a good perception level. In comparison, 44.1% demonstrated a moderate perception level, and the remainder had a poor perception of phlebitis risk factors. This outcome is consistent with other studies, wherein only 56.8% of respondents exhibited an excellent perception of phlebitis risk factors such as acidity, osmolarity, and drug infusion concentration (Ying *et al.*, 2020).

Additionally, this study concluded that most respondents were aware that maintaining hand hygiene and practicing aseptic techniques during cannulated site care could decrease the risk of phlebitis. This practice aligns with guidelines outlined by the Infusion Nurse Society, emphasizing the importance of healthcare professionals maintaining hand hygiene using alcohol-based hand sanitizers or antibacterial soap and water during patient care, including before inserting peripheral vascular catheters (Gorski *et al.*, 2016).

Furthermore, the study revealed that only 90 nurses in critical care units were responsible for daily PIVC handling. It is essential to note that the critical care unit, encompassing cardiac care and cardiac rehabilitation units, does not involve daily PIVC administration for all patients.

Relationship between Knowledge of PIVC and Demographic Data

The results indicate that most of the nurses at the University Hospital in Selangor possess a solid knowledge base regarding PIVC. There was a significant relationship between respondents' demographic data and years of clinical experience, training in PIVC, and frequency of handling PIVC. The study revealed that the clinical experience of the staff greatly influences their knowledge of caring for and maintaining PIVC. It supports a study by Chanu and Reddy (2018) stating that knowledge and clinical experience are associated.

Previous additional training in PIVC care was found to impact knowledge scores significantly. The higher knowledge score observed among nurses who had received additional PIVC training, at 73.5%, aligns with findings from a previous study conducted in adult wards in Egypt and England (Thabet Ahmed *et al.*, 2013). This earlier research demonstrated a notable improvement in nurses' knowledge of PIVC care. These outcomes underscore the importance of offering training through seminars, conferences, and in-house sessions conducted by visiting infusion nursing experts and other healthcare providers in the hospital, as it enhances PIVC knowledge.

Additionally, nurses who consistently participated in and performed PIVC procedures and cared for patients in their daily work achieved higher scores. Westbrook *et al.* (2011) emphasized the significance of nurses gaining experience and knowledge in PIVC care through regular practice and service. This underlines the importance of ongoing training sessions focusing on monitoring for associated complications.

Relationship between the Level of Perception of Phlebitis Risk Factors and Demographic Data

Nearly half of the respondents generally displayed a favorable perception regarding the risk of phlebitis. Significantly, there were associations between respondents' demographic characteristics and their perceptions of phlebitis risk factors, including years of clinical experience, work area, PIVC training, and the frequency of PIVC handling.

Years of clinical experience showed a significant association with the level of perception of the nurses with experience of 10 years and below, who had a good level of perception compared to the nurses with 11 years and above clinical experience. This result is consistent with those of others studied by Milutinovic *et al.* (2015), who stated that nurses with six to ten years of experience in selected veins (veins of the forearm) performed better, mainly in selected veins of the hand.

Furthermore, the working area shows a significant difference between both areas. Nurses from the general ward had a higher percentage of good perceptions compared to nurses from the critical care area. On the other hand, these results contrast the findings from a study by Ho *et al.* (2016), which showed that the mean score of respondents from specialty units was higher than that of medical-surgical services regarding knowledge and practice for managing PIVC. Perhaps further studies are needed to understand the scenario.

Furthermore, nurses who had undergone PIVC training and had regular exposure to PIVC handling demonstrated a favorable perception of phlebitis risk. The need for nursing training on the latest available evidence regarding the use and management of venous catheters is needed (Guanche-Sicilia *et al.*, 2021). The research findings indicated that the educational program had a beneficial impact on the nursing staff's actions related to preventing complications associated with Peripheral Intravenous (Naeli & Hassan, 2021). This suggests that enhancing knowledge of risk factors and implementing altered care practices can effectively diminish the risk of phlebitis. This aligns with the recommendations of the Infusion Nurse Society (O'Grady *et al.*, 2011), which advocates for regular training and competency assessments to guarantee that nurses consistently deliver the highest standard of care.

CONCLUSION

In summary, phlebitis is a frequent complication of peripheral venous catheterization in hospitalized

individuals. In certain regions, nursing personnel may be unaware of phlebitis risk factors. Nursing duties during intravenous treatment encompass initiating, monitoring, upkeep, and cessation of intravenous infusions. Nursing staff must demonstrate proficiency in all aspects of intravenous therapy, including identifying and preventing phlebitis.

Hence, providing proper education, creating a positive attitude, and removing barriers are all essential strategies for increasing nurses' knowledge. Improvements to the process included policy updates, broad awareness campaigns, and a move to closed PIVC products. These enhancements could lower patient complications and treatment delays, enhance patient satisfaction, and decrease the likelihood of PIVC-related issues.

Conflict of Interest

The authors declared no conflict of interest.

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