



Determinants of Nursing Students' Confidence in Peripheral Intravenous Catheter Insertion and Management

Ferika Indarwati^{1*}, Yanuar Primanda²

¹Department of Pediatric Nursing, School of Nursing, Faculty of Medicines and Health Sciences, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia; ²Department of Adult Nursing, School of Nursing, Faculty of Medicines and Health Sciences, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia

Abstract

BACKGROUND: Peripheral intravenous catheter (PIVC) is one of the medical devices commonly inserted in hospitalized patients, both adults and pediatrics. PIVC has crucial functions for delivering drugs, fluids, blood transfusions, and diagnostic tests for patients. Thus, nursing students must be confident in terms of insertion and management of this device. However, studies assessing nursing students' confidence and its determinants are still limited.

AIM: This study aims to examine the internship nursing student's confidence in PIVC insertion and management in adult patients and its contributing factors.

METHODS: A cross-sectional study was conducted to measure internship nursing students' confidence in PIVC cannulation and management in adult patients as well as its contributing factors. Purposive samples of 100 nursing students in Yogyakarta were recruited, and a 5-point Likert scale questionnaire consisting of 19 questions was used. Kruskal–Wallis test was utilized to investigate the association of the internship nursing student confidence on PIVC insertion and maintenance with the factors. A general linear regression analysis was performed to obtain adjusted estimates of the potential factors with students' confidence.

RESULTS: Results indicated that the internship nursing student's confidence score ranged from 57 to 95, with a mean value of 75 (± 8.1). Among determinants of the student's confidence investigated in this study, t-test analysis showed that the students' confidence was associated with their participation in expert lecture, bedside teaching, and direct observation of procedural skill assessment of PIVC insertion and care ($p < 0.05$). The general linear analysis showed that only bedside teaching and interaction of bedside teaching and direct observation procedural skill assessment were significant predictors of the internship nursing student's confidence on PIVC insertion and care ($\beta = 10.99$, 95% confidence interval [CI] 2.00–20.00 and $\beta = 13.15$, 95% CI 1.20–25.15, $p < 0.05$, respectively).

CONCLUSION: This result indicated that nursing students need direct simulation and assessment of PIVC insertion and care to the patients to improve their confidence in PIVC insertion and management in adult patients.

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***Correspondence:** Ferika Indarwati, School of Nursing, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Indonesia.
E-mail: Ferika.indarwati@umy.ac.id
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Introduction

It is estimated that nearly 90% of hospitalized adult patients require peripheral intravenous catheter (PIVC) inserted to receive medications, making PIVC insertion and care the most frequent invasive procedure undertaken, particularly by nurses [1]. Despite its crucial functions to help patients' recoveries, PIVC failure and complications in adult patients are still relatively high, with 34% of PIVC insertion failure before the completion of the intravenous therapy [2]. This failure costs not only the patients but also the health-care systems. The average cost per PIVC procedure and care are predicted to be \$69 in the US and \$237 in Switzerland [3], [4], [5]. Reinsertion procedures can increase pain and anxiety in patients [6], [7]. The pain related to medical procedures experienced by patients during their hospitalizations increases medical fear and procedural pain perceptions, resulting in a reluctance to seek medical care [8].

As the frequent inserters of PIVC, nurses play a significant role in preventing PIVC failure and complications. Therefore, it is paramount that nurses have sufficient knowledge, confidence, and PIVC insertion and care skills. Nurses' competency related to intravenous catheter insertion, use, and care has played an essential role in preventing catheter complications. The Infusion Nursing Society has mentioned that catheter use and care standardization and nurse education and training are vital to optimize peripheral catheter outcomes [9]. Furthermore, health providers expect that graduate nursing students are competent in clinical skills, such as in PIVC insertion and maintenance, to reduce patient safety risks. Therefore, nursing education institutions are responsible for preparing their students to have sound knowledge, confidence, and skill in PIVC insertion and care.

Nevertheless, PIVC placement and care are two of the most challenging skills taught in schools of nursing. To master this skill and prevent unforeseeable PIVC failure and complications, students require knowledge of

the PIVC insertion and care and techniques in performing such invasive procedures and require confidence that can be achieved through many exposures in the clinical learning environment. Confidence has been identified as one of the most important factors supporting nurses in making appropriate decisions in patient care [10], [11]. Several studies reported that nurses with higher self-reported confidence score had faster insertion time, less first insertion failure, and better PIVC outcomes compared to those with lower confidence scores [12].

To improve nursing students' confidence in PIVC insertion and care, nursing students will benefit from better education and a greater PIVC insertion practice volume. Very few studies investigate the influence of teaching-learning programs on students' confidence in PIVC insertion and care. Several studies have found that a blended simulation-based teaching program significantly increased students' self-confidence in PIVC insertion [13]. Similarly, a study conducted by Keleekai *et al.* (2016) in the USA found that nurse's knowledge, confidence, and skills improve significantly after following the blended PIVC insertion training programs that incorporate three simulation practices. Lack of training has been recognized to affect inserter performances, such as selecting proper IV sizes and insertion sites, failing to recognize catheter complications, and complying with guidelines [14]. Nonetheless, the aforementioned studies focused only on PIVC insertion confidence but not the confidence in PIVC care. Successful outcomes of PIVC placement depend not only on the insertion phase but also on its care/maintenance. The maintenance phase is crucial to prevent PIVC complications, such as phlebitis, to prevent premature PIVC removal, and to assure that the catheter does not fail before completing therapy [15].

In our system, the 5th year nursing students are placed in hospitals to obtain a real-world caring patient experience. We called this year an internship year for students. A clinical learning and teaching program called preceptorship incorporating bed side teaching, meet the expert lecture, direct observation procedural skills (DOPSS), supervised clinical examination is implemented during this internship period particularly to address gaps in the internship nursing students' clinical skills. However, there are very limited studies investigating the influence of these learning strategies to enhance students' confidence in performing technical skills frequently undertaken by nurses, such as PIVC insertion and care. Therefore, this study examines the internship nursing student's confidence in PIVC insertion and management in adult patients and factors contributing to the students' confidence.

Methods

A cross-sectional design with an online survey approach was conducted to investigate the internship

nursing students' confidence in the insertion and maintenance of PIVC in adult patients in Yogyakarta, Indonesia. Clinical teaching components, such as students' engagement in PIVC expert lecture, bedside teaching, DOPS, frequency of undertaking PIVC insertion and care with preceptor supervisions, gender, and number of internship stages (the internship program has 9 stages) passed by students, which may influence students' confidence, were also measured. A cross-culturally adapted and validated questionnaire consisted of 19 questions to measure students' confidence in PIVC insertion and care. Each scored on a 5-point Likert scale with the following descriptors: 1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, and 5 = strongly agree. The maximum score was 95 and the minimum score was 19. Cronbach's alpha value was 0.85 ($\alpha = 0.85$, $n = 22$), with individual item alphas ranging from 0.81 to 0.86 ($\alpha = 0.81-0.86$, $n = 22$). This study's ethics approval was obtained from the Institutional Review Board with ethics approval number of 177/EC-KEPK FKIK UMY/VII/2020. The student's participation in this study was totally voluntarily and will not influence student's academic performance.

SPSSTM version 26 was utilized to analyze data. Variables examined in this study were presented as frequency and percentage or as mean \pm SD depending on the variables' type and data distribution. Mann Whitney and Kruskal–Wallis test was utilized to investigate the association of the internship nursing student confidence on PIVC insertion and maintenance with students engagement in PIVC expert lecture, bedside teaching, DOPS, assisting PIVC insertion and care, gender, and number of internship stages (the internship program has 9 stages) passed by students. A general linear regression analysis was performed to obtain adjusted estimates of the potential factors with students' confidence. Only factors that were found significantly associated with the students' confidence in the univariate analysis were included in the adjusted model. Results were expressed as relative risk and 95% confidence intervals (CIs). Statistical significance was set at <0.05 for all analysis conducted in this study.

Results

The study was conducted between April and June 2020. Out of 109 nursing students invited in this research, only 100 students completed the online survey (response rate: 91%). Table 1 shows the descriptive statistics of the variable included in this study. More than two-thirds (78, 78%) of the participating students were female, and 56 (56%) of the respondents had passed three internship stages. Most of the students engaged in PIVC expert lecture 78 (78%), bedside teaching 88

Table 1: Demographic, clinical teaching components, and students' confidence

Variable	Value (n: 100)
Gender	
Male	22 (22%)
Female	78 (78%)
Internship stages passed	
Three stages	56 (56%)
Four stages	25 (25%)
Five stages	19 (19%)
Expert lecturer	
No	22 (22%)
Yes	78 (78%)
Bedside teaching	
No	12 (12%)
Yes	88 (88%)
Direct observational procedural skills	
No	16 (16%)
Yes	84 (84%)
Undertaking PIVC insertion and care under preceptor supervision	
≤2 times	10 (10%)
3–5 times	48 (48%)
≥6 times	42 (42%)
Students confidence	75.2 (±8.1)

PIVC: Peripheral intravenous catheter.

(88%), and DOPS 84 (84%). In our system, students are scheduled (they are not in the same stages) so some of the students may not finish all of their clinical stages (5 stages), this explains why some of them were not having those clinical teaching activities recorded yet. Almost half of the students had 3–5 times of experience doing PIVC insertion and care by themselves in a supervised learning environment. The mean score of the nursing student's confidence in PIVC insertion and care was 75.2 (±8.1).

The students' mean confidence score, as shown in Table 2, was significantly different, particularly for students who engaged in bedside teaching and DOPS compared to those who did not participate in any of the bedside teaching or DOPS (p : 0.037 and 0.044, respectively).

Table 2: Mean difference of the students' confidence score across different categories of the clinical components

Variable	Mean (n: 100)	p-value
Gender		
Male	76 (± 1.65)	0.340
Female	74.8 (± 8.20)	
Internship Stages		
Passed	76.2 (± 8.12)	0.834
Three stages	73.8 (± 8.79)	
Four stages	74.4 (± 7.03)	
Five stages		
Expert lecturer (MTE)		
No	72.5 (± 8.46)	0.079
Yes	76 (± 7.88)	
Bedside Teaching (BST)*		
No	70.7 (± 9.98)	0.037
Yes	75.8 (± 7.66)	
Direct observational Procedural skills (DOPS)*		
No	71.7 (± 9.77)	0.044
Yes	75 (± 7.59)	
Assisting PIVC insertion and care		
≤2 times	72.3 (± 11.4)	0.087
3–5 times	74.3 (± 6.75)	
≥6 times	77 (± 8.44)	

*Significant variable. PIVC: Peripheral intravenous catheter, BST: Bedside teaching, MTE: Meet the expert, DOPS: Direct observation procedural skill.

The adjusted analysis in Table 3 indicated that bedside teaching and interaction between bedside

Table 3: The adjusted analysis of the clinical teaching components and internship nursing students' confidence in PIVC insertion and management

Variable	Estimates	95% CI	t	p-value
(Intercept)	76.32	(74.60–78.03)	87.98	<0.001
BST				
Yes-No*	10.99	(1.88–20.10)	2.39	0.019
DOPS				
Yes-No*	6.04	(–0.07–12.14)	1.96	0.053
BST*DOPS				
No-Yes and No-Yes*	13.15	(1.15–25.14)	2.17	0.032

*Reference category, R^2 : 0.07, p-value overall model: 0.020. PIVC: Peripheral intravenous catheter, CI: Confidence interval, BST: Bedside teaching, DOPS: Direct observation procedural skill.

teaching and DOPS were significant predictors of the student's confidence score ($p < 0.005$), explaining 7% of the data variance. When the DOPS and interaction between bedside teaching and DOPS were held constant, the coefficients would indicate that students who engaged in PIVC bedside teaching had better confidence in PIVC insertion and care compared to students who did not have bedside teaching in PIVC insertion and care (10.99, 95% CI 1.87–20.10).

Discussion

Our findings indicated that the students' had low to moderate confidence to perform PIVC insertion and care in adult patients. Similar findings were reported by a study conducted in Malaysia that most nursing students were not entirely confident in performing invasive procedures on patients [16]. A study conducted in the US also reported that students' baseline confidence in their study was also relatively low. The student's confidence might affect their ability to perform PIVC insertion and maintenance procedures to the patients. Furthermore, students' self-confidence was also significantly associated with their clinical practices' understanding and success. This will subsequently affect students in accepting their role as a nurse [17]. Thus, the clinical teaching and learning program is vital components in nursing education to train nursing students to be competent and professional nurses.

At present, the clinical preceptorship education program that incorporated bedside teaching and direct observational procedural skills assessment was emphasized in nursing education [18], [19], [20]. This education model provided opportunities for students to obtain high exposures in clinical settings as well as learning in a safe, supportive environment. According to the study results, students who participated in bedside teaching had better confidence scores than those who did not participate. Bedside teaching was seen as one of the most essential components of medical as well as nursing education. It provided students with an opportunity to learn invasive procedural skills, such as undertaking PIVC insertion and care directly, and how it was directly performed by their preceptor/mentor to the patients [18], [21], [22], [23].

A study conducted in new graduated nursing students about their perceptions of the effects of clinical simulation on their critical thinking, learning, and confidence suggested that nursing students trained through direct simulation methods such as bedside teaching had more confidence in patients' care [24]. An experimental study conducted in nursing students using pre-test and post-test design on the influence of a clinical simulation elective on baccalaureate nursing student clinical confidence also showed a significant increase of the students' confidence scores in the intervention group, particularly in diagnosis, patient assessment, nursing, and evaluating compared to the control group [25]. An intervention study conducted assessing nursing students of performance level reported that there was a significant increase on the student's self-confidence who were trained through direct simulation compared to the group who were trained using traditional model [26]. A study on the effect of simulation learning on critical thinking and self-confidence when incorporated into an electrocardiogram nursing course also observed similar findings that nursing students' self-confidence increased significantly following simulation programs in addition to lectures compared to those without direct simulation [27].

Direct stimulation to patients with supervision from preceptors/mentors in clinical nursing education provided a supportive environment for students to apply concepts and skills learned within the nursing curriculum which will subsequently increase their decision-making ability and skills essential for nursing care practices [28], [29]. In addition, it also provided a safe environment for students to apply their clinical judgment without posing a greater risk for patients [28], [30]. It is suggested that bedside teaching and DOPS are an approach to clinical education methods and are preferred over the traditional unstructured clinical learning model [21], [23], [31].

Findings in this study also suggested that DOPS is one of the clinical education methods that may benefit students in improving their confidence in PIVC insertion and care. Direct observation of procedural skills is a tool designed for performance-based assessment of clinical skills [20]. DOPS, like bedside teaching, is considered an excellent way of learning in clinical settings. Students are directly observed and assessed with a structured checklist while performing a clinical procedure on actual patients. At the end of the procedure, constructive feedback, both in verbal and written form, is given to the students to identify the areas of strength and areas that need improvement [32]. The DOPS method significantly impacts students' understanding of their weaknesses in both short- and long-term procedural processes [32].

Bedside teaching and DOPS are considered ways to give students hands-on clinical experience, such as acquiring PIVC insertion and care skills [18], [32]. In one study, direct hands-on learning like DOPS was

an essential factor in students' learning programs in building students' confidence [25]. Similar findings were reported by another study that there was a significant correlation between the frequencies a skill was performed and the confidence level of the student [33]. A study assessing students "confidence and the frequency of direct observation conducted also indicated that students' confidence in performing procedural skills was significantly related with the number of DOPSS they performed during their clinical placement [34]. It is suggested that students who obtained more direct observation from their mentor may have been engaging in those skills more often, resulting in better confidence and better clinical performance [35]. Logically, the students' hands-on experience is essential in building students' confidence. However, it is also worth noting that the quality of the direct observation of procedural skills (DOPSS) approach will also determine the clinical education outcomes such as nursing students' confidence on PIVC insertion and care [34].

Conclusion

Our findings suggested that bedside teaching and DOPS seemed to be an excellent education strategy to be implemented in clinical nursing education settings to improve students' confidence and their skills to perform clinical procedures such as PIVC insertion and maintenance. Therefore, nursing education institutions may consider applying these methods into their internship program. However, it should also be noted that bedside teaching and DOPS processes require considerable enthusiasm and commitment from preceptors/mentors, students, and patients' willingness to cooperate, which play a crucial role in this educational method.

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