

# Effects of nurse's knowledge and self-efficacy on nursing performance in pediatric intravenous fluid management in South Korea: a descriptive study

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**Purpose:** This study aimed to identify the effects of nurse's knowledge and self-efficacy on nursing performance in pediatric intravenous fluid management and provide the primary data necessary for the efficient intravenous injection management of hospitalized children. **Methods:** This study was a descriptive study design with 141 nurses who perform pediatric intravenous therapy care at eight hospitals in the S, C, D, and S regions. Data were collected from September 1, 2023, to September 30, 2023. **Results:** Nursing performance of pediatric intravenous injection management was significantly positively correlated with knowledge ( $r=.44, p<.001$ ) and self-efficacy ( $r=.19, p=.022$ ). Nurses' knowledge ( $\beta=.42, p<.001$ ) and self-efficacy ( $\beta=.22, p=.004$ ) of pediatric intravenous injection management and care were identified as significant predictors of nursing performance thereof, with these two factors explaining 21.9% of the variance. **Conclusion:** This study found that knowledge and self-efficacy of pediatric intravenous injection management are significant predictors of the practice of intravenous care among pediatric nurses. Therefore, considering these factors, education and intervention programs should be developed to enhance pediatric nurses' knowledge and self-efficacy regarding intravenous injection management.

**Keywords:** Child, hospitalized; Injections, intravenous; Nurses, pediatric; Self efficacy

## INTRODUCTION

Intravenous therapy (IVT), widely used to administer medication, fluids, parenteral nutrition, and blood products to treat patients, is an invasive procedure performed most frequently on hospitalized patients [1]. IVT is the most common medical practice for hospitalized adults and children. According to a previous study, 63.8% of children hospitalized in pediatric wards in Korea received IVT [2], indicating that most children receive IVT. IV injections require special management since complications, such as phlebitis and redness, pain, swelling, blockage, and infiltration at the injection

site, are common occurrences due to the nature of such injections [3-5].

Children have anatomically thin and immature blood vessels and a thicker subcutaneous fat layer than adults, which presents difficulty in inserting an IV catheter [2]. Moreover, even if an IV catheter is successfully inserted, it is not easy to maintain the IV catheter owing to a lack of patient cooperation, as younger children have difficulty communicating in the early developmental stages [2]. The latest guidelines for IV infusion management for children recommend that IV catheters do not need to be replaced as long as there are no complications; however, in practice, IV catheters are con-

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stantly replaced for hospitalized children as they cannot be maintained for 72 hours due to blockage, infiltration, and swelling in more than half of children [6,7]. A previous study has reported that the mean IV catheter indwell time among hospitalized children was 51.3 hours, and the IV catheter indwell time was even shorter among younger children with lots of body movement [6]. Accordingly, efforts to prevent IV injection-related complications and safely maintain the IV catheter insertion site are emphasized in clinical nursing practice. Moreover, nurses must manage IV injections with accurate knowledge and standardized methods [2].

IV injection management knowledge is an essential component that must be acquired for the overall management of IV injections, proper nursing practice, and complication prevention. Nurses must be able to manage the entire IV injection process by developing skills and knowledge about IV injection management [8].

Clinical guidelines for IVT have been developed and presented by various specialty societies in Korea and abroad. Furthermore, the United States Centers for Disease Control and Prevention (CDC) provides ongoing education for IV line maintenance at the beginning of each year [9]. Nonetheless, the developed IV injection management protocol for children is not being applied in actual clinical practice [10], and hospitals are creating and using in-house IV injection management methods; therefore, standardized guidelines are not being used. Consequently, the contents of IV injection management nursing vary among hospitals and wards. Management guidelines passed down by apprenticeship training do not reflect the latest knowledge and can act as a barrier that prevents proper IV injection management due to lack of knowledge. In clinical practice, nurses must promote enhanced patient safety and quality of care by actively accepting the latest evidence-based nursing knowledge and information to develop their specialization.

Nursing knowledge is an essential component of scientific nursing; however, having a high level of knowledge does not necessarily lead to proper nursing practice [11,12]. According to previous studies, self-efficacy is an important variable influencing nursing performance. Yoo [13] has found a positive correlation between self-efficacy and nursing performance in pediatric nursing, and Jang and Yeom [14] have found a positive correlation between self-efficacy and nursing performance in hospice-palliative care nurses. Accordingly, self-efficacy has been reported to motivate and improve the activities of individuals in nursing practice while positively affect-

ing nursing performance [15].

Therefore, knowledge and self-efficacy can be considered critical variables for enhancing IV injection management among pediatric nurses, and studies should be conducted to investigate the relationship between these variables. Most studies on IV injection management performance have focused on nurses' job satisfaction, infection control, and complication prevention. Furthermore, studies on pediatric nurses have focused on job satisfaction, nurses' stress, caregiver satisfaction, and children's anxiety [16,17]. Accordingly, this study aims to identify the factors influencing nursing performance in pediatric nurses' intravenous injection management and provide the primary data for efficiently managing peripheral IV injections in hospitalized children.

## METHODS

**Ethical statements:** This study obtained approval from the Institutional Review Board (IRB) of Chungbuk National University Hospital (IRB approval number: 2023-06-001-001). Informed consent was obtained from all participants.

### 1. Study Design

This descriptive study identifies the effects of nurse knowledge and self-efficacy on nursing performance in pediatric intravenous fluid management. The reporting of this study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines [18].

### 2. Participants

This study used convenience sampling to recruit nurses from eight hospitals (one tertiary hospital from the S region, one tertiary hospital, one general hospital, three children's hospitals from the C region, one general hospital from the D region, and one children's hospital from the S region). The eligibility criteria for participants in this study included having at least 6 months of experience working in a pediatric ward, performing IV injection management for children, and providing informed consent to participate in the study. The eligible participants required for this study were calculated using G\*power 3.1.9.7 statistical software. The minimum sample size was 131, calculated using a two-tailed test at a significance level of .05, power of .80, effect size of .15, and 13 pre-

dictor variables (10 general characteristics, nurses' knowledge of pediatric intravenous injection management, nurses' self-efficacy of pediatric intravenous injection management, and nursing performance in pediatric intravenous injection management. A total of 150 questionnaires were distributed and returned. After excluding nine questionnaires for incomplete responses, data from 141 questionnaires were used in the final analysis.

### 3. Measurements

All scales used in this study were used with prior approval. The questionnaire consisted of 74 items, 10, 10, 17, and 37, regarding general characteristics, nurses' knowledge about pediatric IV injection, nurses' self-efficacy related to pediatric IV injection management, and nurses' performance related to pediatric IV injection management, respectively.

#### 1) General characteristics

The participants' characteristics regarding age, marital status, children, religion, education, total clinical career, clinical career in the pediatric unit, position, nurse-to-patient ratio, and hospital type were collected.

#### 2) Nurses' knowledge of pediatric intravenous injection management

Knowledge was measured using a 10-item tool created by Choi et al. [10] based on the nursing protocol for peripheral catheter management in children outlined by the children's hospital of a tertiary hospital in Seoul in 2015. Each item is scored based on an answer of "correct" (1 point), "incorrect" (0 point), or "do not know" (0 point). The total scores range between 0 and 10 points, with higher scores indicating higher knowledge levels. The tool's reliability (Cronbach's  $\alpha$ ) was not presented when this tool was developed initially. Nonetheless, each item's content validity index (CVI) ranged between 0.0 and 1.0, and the CVI of all items was 0.96.

#### 3) Nurses' self-efficacy in pediatric intravenous injection management

Self-efficacy was measured using the General Self-Efficacy Scale, initially developed by Sherer et al. [19] and subsequently modified and updated by Jung [20]. This tool comprises 17 items, with each item rated on a 5-point Likert scale (1: "not at all" to 5: "always"). The total scores range between 17 and 85 points, with higher scores indicating higher self-efficacy.

The tool's reliability (Cronbach's  $\alpha$ ) was .86 at the time of development, .94 in the study by Jung [20], and .97 in this study.

#### 4) Nursing performance in pediatric intravenous injection management

Nursing performance was measured using a tool developed by Choi et al. [10] based on the nursing protocol for pediatric peripheral catheter management developed by the children's hospital of a tertiary hospital in Seoul in 2015. This tool comprises 37 items in five domains: "education" (2 items), "dressing and fixation" (7 items), "maintenance and management" (7 items), "observation and recording" (9 items), and "complications management" (12 items). Each item is rated on a 4-point Likert scale (1: "not at all" to 4: "always"). The total scores range between 37 and 148 points, with higher scores indicating higher nursing performance levels. The CVI value of each item in this tool ranged between 0.8 and 1.0, and the CVI value of all items was 0.97. The tool's reliability (Cronbach's  $\alpha$ ) was .92 at the time of its development. In this study, the reliability (Cronbach's) of the tool was .92, while the reliability of each domain was .81, .77, .57, .79, and .84 for education, dressing and fixation, maintenance and management, observation and recording, and complications management, respectively.

### 4. Data Collection

Approval was obtained from the IRB of Chungbuk National University Hospital before data collection. Nursing departments in eight hospitals with pediatric wards, including tertiary, general, and children's hospitals, were contacted in advance. The data collection period was September 1–30, 2023. The researcher visited the nursing department of each hospital to distribute the questionnaire and explain the purpose and methods of the study. Subsequently, the researchers informed the heads of department and research participants about the purpose and methods of the study; the privacy, anonymity, and confidentiality of questionnaire data; the potential risks and benefits of participating in the study; and the right to withdraw from the study at any time without any negative repercussions. Only those who voluntarily agreed to participate in the study were asked to submit a written consent form, after which the questionnaire survey was conducted. The researchers revisited each ward to collect the questionnaire and presented a token of appreciation for participating. For the protection of personal information, the re-

searchers collected the completed questionnaires from the participants (face-to-face) and placed them in a sealed envelope. Data were anonymized, and the researcher performed data synthesis solely.

For hospitals that had provided prior permission but were challenging to visit personally, an email containing information about the study's purpose and methods; the privacy, anonymity, and confidentiality of participant data; the potential risks and benefits of participating in the study; and the right to withdraw from the study at any time without any negative repercussions was sent to the head of the nursing department at each hospital, together with a URL link for the online questionnaire (Google Form). The department heads subsequently shared this with the participants through the department member messenger app. The online questionnaire contained an optional field for entering contact information to send a token of appreciation upon completion; furthermore, it was outlined that such personal information would be destroyed immediately after sending the token of appreciation. After obtaining the consent form, the survey was conducted in a self-reporting format. Completed questionnaires were collected online using a Google Form.

## 5. Data Analysis

The collected data were analyzed using SPSS Windows software (IBM SPSS Statistics ver. 29.0, IBM Corp.). Participant characteristics were analyzed using frequencies, percentages, means, and standard deviations. Descriptive statistics for the study variables were analyzed using means, standard deviations, minimums, and maximums. Nursing knowledge in pediatric intravenous injection management was analyzed using correct answer rates. The differences in study variables according to participant characteristics were analyzed using an independent t test and a one-way analysis of variance with the Scheffé test. Pearson correlation coefficients analyzed the correlation between study variables. Factors affecting nursing performance in pediatric intravenous injection management were analyzed using multiple regression analysis.

# RESULTS

## 1. Participant Characteristics

The mean age of the participants was 33.8 years, with those

aged 20–29 and 30–39 years accounting for 78.1% ( $n=110$ ) of the participants. Moreover, 55.3% ( $n=78$ ) were married, 44.7% ( $n=63$ ) had children, and 72.3% ( $n=102$ ) declared no religion. Regarding education level, 34 (24.1%), 94 (66.7%), and 13 (9.2%) participants responded to college, university, and masters or higher, respectively.

Regarding total clinical experience, 40 (28.4%), 34 (24.1%), 42 (29.8%), and 25 (17.7%) participants had <5, 5–9, 10–14, and  $\geq 15$  years of experience, respectively. Regarding work experience in a pediatric ward, 77 (54.6%), 39 (27.7%), 20 (14.2%), and 5 (3.5%) participants had <5, 5–9, 10–14, and  $\geq 15$  years of experience, respectively. The mean total clinical experience was  $9.00 \pm 6.13$  years, and the mean work experience in a pediatric ward was  $5.00 \pm 4.53$  years. Of the participants, 74.5% ( $n=105$ ) were staff nurses. Regarding the nurse-to-patient ratio, <20 was 47.5% ( $n=67$ ), and  $\geq 20$  was 52.5% ( $n=74$ ). Regarding hospital type, 86 (61.0%), 27 (19.1%), and 28 (19.9%) participants worked in children's, general, and tertiary hospitals, respectively (Table 1).

## 2. The Differences in Study Variables According to the Participant Characteristics

The differences in nursing performance related to pediatric IV injection management according to the characteristics of the participants are shown in Table 1. The results showed statistically significant differences in nursing performance according to education ( $F=3.43$ ,  $p=.035$ ) and hospital type ( $F=4.83$ ,  $p=.009$ ). The nursing performance scores were higher among those with a masters degree or higher than those with college or university education levels and those working in a tertiary hospital than those working in a general hospital.

## 3. Descriptive Statistics for Study Variables

The mean scores for knowledge, self-efficacy, and nursing performance of pediatric IV injection management were  $7.29 \pm 1.35$  out of 10,  $3.72 \pm 0.71$  out of five, and  $3.35 \pm 0.42$  out of four, respectively. Regarding the mean scores for each domain, dressing and fixation of the IV injection site had the highest score of  $3.52 \pm 0.50$  points, followed in order by observation and recording with  $3.48 \pm 0.44$  points, complications management with  $3.32 \pm 0.51$  points, maintenance and management with  $3.21 \pm 0.52$  points, and education with  $2.77 \pm 0.87$  points (Table 2).

**Table 1.** Characteristics of Participants & the Differences in Study Variables according to Characteristics of Participants (N=141)

Characteristics	Categories	n (%)	M±SD	Nursing performance		
				M±SD	t/F	p
Age (year)	20–29	49 (34.8)	33.80±7.59	3.39±0.49	0.47	.704
	30–39	61 (43.3)		3.34±0.37		
	40–49	27 (19.1)		3.27±0.44		
	≥50	4 (2.8)		3.32±0.08		
Marital status	Married	78 (55.3)		3.40±0.39	1.74	.085
	Single	63 (44.7)		3.28±0.45		
Children	Yes	63 (44.7)		3.36±0.43	0.26	.797
	No	78 (55.3)		3.34±0.42		
Religion	Yes	39 (27.7)		3.41±0.38	1.10	.274
	No	102 (72.3)		3.32±0.44		
Education	College <sup>a</sup>	34 (24.1)		3.19±0.45	3.43	.035 (a < c)
	University <sup>b</sup>	94 (66.7)		3.39±0.41		
	≥ Master <sup>c</sup>	13 (9.2)		3.47±0.30		
Total clinical career (year)	<5	40 (28.4)	9.00±6.13	3.38±0.49	0.66	.578
	5–9	34 (24.1)		3.40±0.39		
	10–14	42 (29.8)		3.28±0.40		
	≥15	25 (17.7)		3.33±0.40		
Clinical career in pediatric unit (year)	<5	77 (54.6)	5.00±4.53	3.34±0.45	0.18	.909
	5–9	39 (27.7)		3.39±0.42		
	10–14	20 (14.2)		3.31±0.33		
	≥15	5 (3.5)		3.31±0.43		
Position	Staff	105 (74.5)		3.31±0.43	-1.71	.089
	Manager	36 (25.5)		3.45±0.39		
Nurse-to-patient ratio	<20	67 (47.5)	20.01±9.25	3.38±0.45	0.90	.370
	≥20	74 (52.5)		3.32±0.40		
Hospital type	Children's hospital <sup>a</sup>	86 (61.0)		3.32±0.42	4.83	.009 (b < c)
	General hospital <sup>b</sup>	27 (19.1)		3.23±0.48		
	Tertiary hospital <sup>c</sup>	28 (19.9)		3.55±0.31		

M, mean; SD, standard deviation.

**Table 2.** Descriptive Statistics for Study Variables (N=141)

Variables	M±SD	Minimum	Maximum	Range
Knowledge	7.29±1.35	3.00	10.00	0–10
Self-efficacy	3.72±0.71	1.24	5.00	1–5
Nursing performance	3.35±0.42	1.92	4.00	1–4
Dressing and fixation	3.52±0.50	1.57	4.00	1–4
Observation and recording	3.48±0.44	2.00	4.00	1–4
Complications management	3.32±0.51	2.00	4.00	1–4
Maintenance and management	3.21±0.52	1.86	4.00	1–4
Education	2.77±0.87	1.00	4.00	1–4

M, mean; SD, standard deviation.

#### 4. Correlation between Study Variables

The correlations between nursing performance and the study variables are shown in Table 3. Nursing performance showed a statistically significant positive correlation with nursing knowledge ( $r = .44, p < .001$ ) and self-efficacy ( $r = .19, p = .022$ ).

**Table 3.** Correlation Between Study Variables (N=141)

Variables	Knowledge	Self-efficacy	Nursing performance
	r (p)		
Knowledge	1		
Self-efficacy	-.05 (.594)	1	
Nursing performance	.44 (< .001)	.19 (.022)	1

### 5. Factors Affecting Nursing Performance in Pediatric Intravenous Injection Management

A multiple regression analysis was performed to identify the factors affecting nursing performance regarding pediatric IV injection management. Four variables were inputted as independent variables, including two (education and hospital type) that showed significant differences with nursing performance in the univariate analyses and two (knowledge and self-efficacy) with confirmed correlation in the correlation analyses. Of these, two nominal variables, education and hospital type, were inputted after being converted into dummy variables.

When the assumptions of the regression analysis were tested, the results showed that the Durbin-Watson statistic was 1.99, confirming independence without the autocorrelation of errors, while the tolerance between the independent variables was  $\geq 0.1$  (range: .84-.94) and the variance inflation factor was below the cutoff of 10 (1.07-1.19), indicating no multicollinearity problems.

The analysis results confirmed that nurse’s knowledge ( $\beta = .42, p < .001$ ) and self-efficacy ( $\beta = .22, p = .004$ ) affect nursing performance regarding pediatric IV injection management. These factors showed an explanatory power of 21.9% ( $F = 10.82, p < .001$ ) for nursing performance, and the most influential variable was identified to be nurse’s knowledge (Table 4).

## DISCUSSION

In this study, the mean score for knowledge regarding pediatric IV injection management among nurses was 7.29 out of 10 points, higher than the 5.81 points reported by Choi et al. [10] on pediatric ward nurses using the same tool. While direct comparison and review are difficult due to the scarcity of studies using the same tool, the results from studies using other tools to measure knowledge are as follows. Kim [21]

investigated IV injection knowledge among new nurses and reported a mean score of 24.5 out of 35 points, similar to the present study. A study by the National Evidence-based Healthcare Collaborating Agency (NECA) [22] on knowledge about injection-related infection among healthcare service providers reported a mean score of 9.60 out of 13 points. In comparison, a study by Choi and Jeong [23] on nurses in small and medium hospitals reported a mean IV injection management knowledge score of 25.63 out of 29 points. Considering that there are only a few studies on the knowledge of pediatric IV injection management among nurses and the studies use different definitions and measurement tools, future research must use a standardized tool to explore the factors of pediatric nurses’ knowledge of IV injection management.

The IV infusion practice guidelines from the CDC and Hospital Nurses Association recommend that children’s peripheral IV catheters should not be changed regularly but rather as needed based on the clinical condition of the patient [10]. However, nurses do not receive regular education about revised or modified IV injection management guidelines in actual clinical practice, which can explain the results of previous studies. A study by Kim [21] reported that the “Educational method is not systematic” was the predominant response from an educational aspect in interviews with new nurses regarding IV injections. Therefore, it is necessary to provide nurses with regular educational opportunities to acquire the latest nursing knowledge using conferences and continuing education in nursing practice. Such efforts can help nurses enhance their knowledge related to their specialty and increase the efficiency of their nursing work, which can contribute to improving the quality of patient care. Therefore, nurses must continually develop their specialty to adapt to the rapidly changing healthcare environment. In a study by Huang et al. [24] on factors influencing pediatric nurses’ knowledge and attitude concerning peripheral IV catheters, the level of knowledge was higher among nurses

**Table 4.** Factors Affecting Nursing Performance on Pediatric Intravenous Injection Management (N=141)

Variables	B	SE	$\beta$	t	p
(Constant)	1.86	0.24		7.65	<.001
Education <sup>a)</sup>	0.06	0.08	0.06	0.76	.451
Hospital type <sup>b)</sup>	0.03	0.07	0.04	0.48	.635
Knowledge	0.13	0.03	0.42	5.18	<.001
Self-efficacy	0.13	0.04	0.22	2.90	.004
$F = 10.82 (p < .001), R^2 = .241, \text{Adjusted } R^2 = .219$					

Reference group: <sup>a)</sup>Education $\geq$ Master, <sup>b)</sup>Hospital type; tertiary hospital.

in higher positions. This difference could be due to nursing knowledge accumulated based on that acquired through clinical experience and education. IV injection requires sufficient practice and expertise since it is an essential skill in patient care. However, unlike nurses in higher positions, new nurses have fewer opportunities to perform IV injections in clinical practice beyond observation and explanation-based practical training. There is a growing trend for medical institutions to establish educational plans and teach efficient IV injection management to resolve this problem.

In this study, the mean score for self-efficacy related to pediatric IV injection management among nurses was 3.72 out of 5 points. A study by Cho and Bang [25] on pediatric nurses using the same tool reported a mean score of 3.64, and a similar study by Youn and Noh [26] reported a mean score of 3.60.

In this study, the mean score for nursing performance related to IV injection management for children among nurses was 3.35 out of 4 points. In a study by Kim and Jung [27] on nurses working in children's hospitals using the same scale, the mean score was similar, with 3.42 points. Direct comparison and review of these results are difficult due to the scarcity of studies using this tool; however, a study by Choi and Jeong [23] on nurses in small and medium hospitals reports a mean score of 4.41 out of 5 points for performance of IV practice for infection prevention and Mo [28] reports a mean score of 3.27 out of 4 points for nursing performance for prevention of IVT complications. According to the NECA [22], a survey of healthcare service providers (physicians, nurses, nursing assistants, etc.) regarding the performance of IV injection practice revealed that over 15% of the respondents gave the response "average" or "not perform" on 13 items. The factor contributing to low performance was the lack of education opportunities related to IV injection practice. This suggested the need for systematic guidelines and education for IV injection management. For instance, a study by Choi et al. [10] compared performance scores before and after peripheral IV injection nursing protocol training among pediatric nurses and found a significant increase in the mean score from 3.14 before training to 3.56 after training. Therefore, increased knowledge from education has a positive influence on nursing performance.

Regarding the scores for the domains of nursing performance, "dressing and fixation of peripheral IV injection site" had the highest mean score with 3.52 out of 4 points, followed in order by "observation and recording" (3.48 point),

"complications management" (3.32 point), "maintenance and management" (3.21 point), and "education" (2.77 point). In a study by Choi et al. [10] using the same tool, "Received regular education for IVT principles and practice" had the lowest score in the "education" domain, which was consistent with the findings in the present study. Moreover, a study by Jeong [29] on staff nurses reports that education related to IV injection consists mostly of education received when newly hired. IV injection-related education is rarely included in regular continuing education. Kim and Jung [27] was conducted in the same context as the present study. Therefore, plans to address these issues regarding IV injection-related education are needed.

The findings showed differences in the nursing performance related to IV injection management depending on education level and hospital type. The highest nursing performance scores were found among nurses with a masters degree or a higher education level, followed by a university and college degree in this order. Concerning hospital type, nursing performance scores were highest among nurses working in tertiary hospitals, followed by children's hospitals and general hospitals in this order. While a direct comparison was difficult owing to the lack of studies on nursing performance related to IV injection management among pediatric nurses, our findings were consistent with those of a previous study [28] reporting that high nursing performance was associated with the highest education level. Choi et al. [10] used the same tools as this study to investigate pediatric nurses in tertiary hospitals; items with high scores were the nurses were already familiar with through their participation in new training, infection management, and safety training. As demonstrated, tertiary hospitals have a relatively better system for new nurse training, work training, and conferences than children's and general hospitals. Therefore, it is necessary to establish measures for developing and regularly implementing standardized training that each hospital can use to enhance nursing performance.

Knowledge about pediatric IV injection management among nurses showed a statistically significant positive correlation with nursing performance, which means that nursing performance is higher among pediatric nurses with higher knowledge levels regarding IV injection management for children. This was consistent with Choi et al. [10], who reported a significant positive correlation between knowledge about IV injection management and nursing performance; Choi and Jeong [23], who reported a positive correlation be-

tween knowledge and IV injection practice for infection prevention; and Adejumo and Dada [30], who reported a positive correlation between performance and knowledge about safe injection practice. Therefore, nurses should regularly evaluate and supplement their level of knowledge about IV injection management.

In addition, a statistically significant positive correlation between self-efficacy and nursing performance among nurses was found, which indicates that nursing performance is higher among pediatric nurses with higher self-efficacy related to pediatric IV injection management. Similarly, Lee et al. [11] reported that nursing practice was higher among nurses with higher self-efficacy for oxygen therapy. Moreover, Chung [31] reported a positive correlation between nursing performance and self-efficacy after educational intervention. Based on these results, hospitals need to provide support with human resources management to achieve increased self-efficacy and work performance and qualitative improvement in nursing through performance-enhancing educational and motivational programs for pediatric nurses [32].

In this study, knowledge about pediatric IV injection management was the most significant influence on nursing performance. This indicates that pediatric nurses perform better with higher knowledge levels regarding IV injection management for children. A study by Shahzeydi et al. [33] on the relationship between knowledge and performance regarding the preparation and injection of IV drugs among 156 pediatric nurses in Iran reported that knowledge and performance among pediatric nurses were low, which would lead to adverse outcomes for children. These findings are consistent with those in the present study. A study by Choi et al. [10] also reported that nurses who received education on peripheral IV injection nursing protocol for children showed improved knowledge about IV injections and higher performance in related work. Therefore, opportunities to provide sufficient information and education regarding standardized IV injection protocol and on-the-job training should be expanded as measures for increasing nursing performance for IV injection management among pediatric nurses. Moreover, nurses are responsible for using critical thinking based on their own work experience and scientific research findings. As healthcare professionals, nurses should promote improved quality of care through continued evidence-based nursing practice.

Self-efficacy had the second most significant influence on nursing performance, indicating that pediatric nurses with

higher self-efficacy for IV injection management perform better. Such results can be attributed to nurses with higher self-efficacy investing more effort in self-development to provide better-quality care to children. Previous studies on pediatric nurses have confirmed that nurses with higher self-efficacy showed better performance in pain nursing intervention [34,35]. High self-efficacy has a positive influence on problem-solving and decision-making abilities [36]; therefore, it is recommended that programs that enhance self-efficacy among pediatric nurses are developed and studies for testing the effects of such programs are conducted.

This study has several limitations. First, because this study included only pediatric nurses from a specific region, there are limitations in generalizing the findings to all nurses. Second, few studies used the same tool as this study; thus, comparisons could only be made with studies that used similar tools. Third, the tool used to measure knowledge about pediatric IV injection management included items that required revision. Therefore, the tool's reliability was low. Replication studies through revision and supplementation are needed in the future. Fourth, the tool used to measure self-efficacy pediatric IV injection was designed to assess general self-efficacy. Therefore, we propose future studies to develop and apply a tool specifically designed to measure self-efficacy related to IV injection management. Replication studies through revision and supplementation are needed in the future.

Nonetheless, the significance of this study is that it provided basic data for developing educational and interventional programs for enhancing nursing performance related to pediatric IV injection management by identifying knowledge and self-efficacy as variables associated with nursing performance among pediatric nurses.

## CONCLUSION

This study was conducted to identify factors influencing the performance of pediatric intravenous administration nursing to provide essential data for efficiently maintaining and managing peripheral IV injections for hospitalized children. In conclusion, for pediatric nurses to efficiently perform IV injection management, they must explore programs and measures that can enhance their knowledge and self-efficacy, for which institutional policies and support are essential. The findings of this study can be used as foundational data for developing and utilizing various programs for managing nursing organizations to enhance nursing performance in IV



injection management for children among pediatric nurses.

## ARTICLE INFORMATION

### Authors' contribution

Conceptualization: all authors; Data collection and Formal analysis: Se-Won Kim; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

### Conflict of interest

No existing or potential conflict of interest relevant to this article was reported.

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### Data availability

Please contact the corresponding author for data availability.

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## REFERENCES

- Hong I, Eun Y. Development and effectiveness of practice application program of intravenous infusion evidence-based nursing practice guideline - for small and medium sized hospitals. *Journal of Korean Academy of Nursing*. 2020;50(6):863-875. <https://doi.org/10.4040/jkan.20196>
- Choi HK, Kang MJ, Kang HJ, Kim EH, Bang KS. Development of an evidence-based nursing protocol for management of peripheral catheters in children. *Journal of Korean Clinical Nursing Research*. 2016;22(1):56-67.
- Kim JS, Lee YR, Kim NS. Effects of the structured nursing intervention for caregivers on maintenance of intravenous infusions in infants. *Journal of Korean Academy of Child Health Nursing*. 2012;18(3):135-142. <https://doi.org/10.4094/jkachn.2012.18.3.135>
- Indarwati F, Mathew S, Munday J, Keogh S. Incidence of peripheral intravenous catheter failure and complications in paediatric patients: systematic review and meta analysis. *International Journal of Nursing Studies*. 2020;102:103488. <https://doi.org/10.1016/j.ijnurstu.2019.103488>
- Danski MT, Mingorance P, Johann DA, Vayego SA, Lind J. [Incidence of local complications and risk factors associated with peripheral intravenous catheter in neonates]. *Revista da Escola de Enfermagem da U S P*. 2016;50(1):22-28. <https://doi.org/10.1590/s0080-623420160000100003> Portuguese
- Sung SH, Kim HS. Risk factors of intravenous infiltration in children. *Clinical Nursing Research*. 2007;13(2):61-72.
- Kleidon TM, Gibson V, Cattanach P, Schults J, Royle RH, Ware RS, et al. Midline compared with peripheral intravenous catheters for therapy of 4 days or longer in pediatric patients: a randomized clinical trial. *JAMA Pediatrics*. 2023;177(11):1132-1140. <https://doi.org/10.1001/jamapediatrics.2023.3526>
- Kim JI, Lee J, Chang O. Perceived importance and performance of intravenous fluid therapy by nurses in small-medium general hospitals. *Journal of Korean Academy of Fundamentals of Nursing*. 2013;20(4):372-380. <https://doi.org/10.7739/jkafn.2013.20.4.372>
- Woody G, Davis BA. Increasing nurse competence in peripheral intravenous therapy. *Journal of Infusion Nursing*. 2013;36(6):413-419. <https://doi.org/10.1097/nan.000000000000013>
- Choi H, Kang M, Kang H, Kim E. The application and effect of the nursing protocol of pediatric peripheral intravenous infusion. *Perspectives in Nursing Science*. 2017;14(2):45-54. <https://doi.org/10.16952/pns.2017.14.2.45>
- Lee KA, Kim HS, Lee YW, Ham OK. Factors influencing compliance with standard precautions in intensive care unit and emergency room nurses. *Journal of Korean Academy of Fundamentals of Nursing*. 2012;19(3):302-312. <https://doi.org/10.7739/jkafn.2012.19.3.302>
- Lee S. The effect of knowledge and self-efficacy on hospital nurses nursing performance regarding oxygen therapy [dissertation]. Seoul: Seoul National University; 2013. p. 1-104.
- Yoo HR. Relationship among the knowledge, self-efficacy and nursing practices of nurses in the management of pediatric pain [dissertation]. Seoul: Seoul National University; 2015. p. 1-84.
- Jang BJ, Yeom HA. Hospice-palliative care nurses' knowledge of delirium, self-efficacy and nursing performance on delirium. *Kore-*

- an Journal of Hospice and Palliative Care. 2018;21(2):65-74. <https://doi.org/10.14475/kjhpc.2018.21.2.65>
15. Ko YK, Kang K. A study on the relationship between self-efficacy, collective-efficacy and job stress in the nursing staff. *Journal of Korean Academy of Nursing Administration*. 2006;12(2):276-286.
  16. Jeong KI, Bae YS, Lee JW. Effects of distraction by an animation on pain and fear during venepuncture of hospitalized preschool children. *Journal of the Korean Data Analysis Society*. 2010;12(2):865-875.
  17. Hwang E. The effect of education for caregivers and active participation of caregivers during peripheral vein injection for pediatric patients [dissertation]. Chuncheon: Kangwon National University; 2015. p. 1-63.
  18. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ*. 2007;335(7624):806-808. <https://doi.org/10.1136/bmj.39335.541782.AD>
  19. Sherer M, Maddux JE, Mercandante B, Prentice-dunn S, Jacobs B, Rogers RW. The self-efficacy scale: construction and validation. *Psychological Reports*. 1982;51(2):663-671. <https://doi.org/10.2466/pr0.1982.51.2.663>
  20. Jung AS. A Study on the relations between a health promoting behaviors and self-efficacy in general hospital nurse [dissertation]. Seoul: Hanyang University; 2007. p. 1-60.
  21. Kim HY. Effect of intravenous injection education program on Intravenous injection knowledge, performance confidence, and primary success rate of new nurses. *Journal of Learner-Centered Curriculum and Instruction*. 2021;21(17):845-854. <https://doi.org/10.22251/jlcci.2021.21.17.845>
  22. Choi JE, Ko EB, Kim SK, Lee HI, Choi SJ. A study on management measures for the safe use of injectable drugs to enhance patient safety, 2017 [Internet]. 2016 [cited 2023 December 8]. Available from: [https://www.neca.re.kr/synap/report\\_preview.do?seq=212&key=1&cms\\_menu\\_seq=145](https://www.neca.re.kr/synap/report_preview.do?seq=212&key=1&cms_menu_seq=145)
  23. Choi SA, Jeong SY. Factors influencing compliance in intravenous practice for infection prevention among nurses in small and medium hospitals. *Journal of Korean Academy of Fundamentals of Nursing*. 2020;27(4):344-355. <https://doi.org/10.7739/jkafn.2020.27.4.344>
  24. Huang LS, Huang Y, Hu J. Current practices of peripheral intravenous catheter fixation in pediatric patients and factors influencing pediatric nurses' knowledge, attitude and practice concerning peripheral intravenous catheter fixation: a cross-sectional study. *BMC Nursing*. 2021;20(1):236. <https://doi.org/10.1186/s12912-021-00758-1>
  25. Cho EJ, Bang KS. Nursing professionalism, self-efficacy and nurse parent partnership in pediatric nurses. *Child Health Nursing Research*. 2013;19(2):94-101. <https://doi.org/10.4094/chnr.2013.19.2.94>
  26. Youn SJ, Noh JH. The influence of emotional labor and self-efficacy of nurses at children's hospital on their partnership with parents. *Journal of Home Health Care Nursing*. 2018;25(1):15-24. <https://doi.org/10.22705/jkashcn.2018.25.1.015>
  27. Kim JH, Jung IS. Factor affecting on recognition and performance of peripheral intravenous infusion management among pediatric nurses. *Journal of Convergence for Information Technology*. 2019;9(12):104-114.
  28. Mo MH. Level of performance of nurses and inhibiting factors regarding the prevention of peripheral intravenous therapy complications [dissertation]. Daegu: Kyungpook National University; 2007. p. 1-41.
  29. Jeong MR. Perception and performance on the prevention management of peripheral intravenous therapy complications [dissertation]. Suwon: Ajou University; 2010. p. 1-50.
  30. Adejumo PO, Dada FA. A comparative study on knowledge, attitude, and practice of injection safety among nurses in two hospitals in Ibadan, Nigeria. *International Journal of Infection Control*. 2013;9(1):<https://doi.org/10.3396/ijic.v9i1.004.13>
  31. Chung MS. Relationship between knowledge and performance of infection control among nurses in the neonatal intensive care unit [dissertation]. Seoul: Yonsei University; 2002. p. 1-60.
  32. Park ES. The relation between self-efficacy and work performance ability of the operation room nurses [dissertation]. Seoul: Hanyang University; 2014. p. 1-67.
  33. Shahzeydi A, Kalhor F, Khaksar S, Sabzghabae AM, Joonbakhsh F, Ajoodanian N. Evaluation of nurses' knowledge and performance regarding preparation and injection of intravenous drugs in pediatric wards in Iran. *BMC Pediatrics*. 2023;23(1):531. <https://doi.org/10.1186/s12887-023-04336-z>
  34. Kim EH, Choi MY. Factors affecting nursing interventions for pain among nurses in neonatal intensive care unit. *Child Health Nursing Research*. 2017;23(2):179-189. <https://doi.org/10.4094/chnr.2017.23.2.179>
  35. Heo SJ, Kim JS, Kim H. Factors influencing pain management practice in pediatric nurses. *Child Health Nursing Research*. 2016;22(4):279-288. <https://doi.org/10.4094/chnr.2016.22.4.279>
  36. Dogu Kokcu O, Cevik C. The predictive strength of students' self-efficacy, problem solving skills to perform catheter care. *Journal of Korean Academy of Nursing*. 2020;50(3):411-418. <https://doi.org/10.4040/jkan.20002>