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NURSES' KNOWLEDGE, PRACTICES AND BARRIERS TOWARDS CARE AND MAINTENANCE IN PEDIATRIC PERIPHERAL INTRAVENOUS CANNULATION

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Abstract

Background: *Peripheral intravenous (IV) cannulation is a fundamental yet challenging procedure in pediatric care due to children's physiological and psychological sensitivity. This study assessed nurses' knowledge, practices, and perceived barriers in pediatric IV cannula care and maintenance.*

Materials and Methods: *A descriptive cross-sectional design was used with 100 registered nurses in pediatric wards of a tertiary care hospital. Data were collected through a validated questionnaire covering knowledge, practice, and barriers, and analyzed using SPSS with descriptive and inferential statistics. Ethical approval and informed consent were obtained.*

Results: *Findings revealed moderate knowledge in 62% of nurses, with only 27% demonstrating high-level evidence-based knowledge. Adherence to IV maintenance protocols was variable, with deficiencies in infection prevention and site monitoring. Reported barriers included heavy workloads, insufficient training, lack of pediatric-specific protocols, and limited institutional support.*

Conclusion: *Strengthening competency-based training, standardized pediatric protocols, improved nurse-patient ratios, and institutional support are essential for enhancing pediatric IV therapy outcomes.*

INTRODUCTION

Safe and secure patient care is central to well-being, with safety strongly linked to health promotion and illness prevention (Osti et al., 2019). In resource-constrained environments such as Pakistan, healthcare delivery is challenged by weak infrastructure, limited medical supplies, and workforce shortages. Inpatients frequently require venous access, a common invasive procedure that carries risks when care is suboptimal (Mohamed et al., 2020). Oversights in intravenous (IV) cannulation management can result in complications including phlebitis, extravasation, thrombosis, and infections, which increase morbidity, mortality, and healthcare costs. Thus, investigating the knowledge, practices, and barriers among nurses is vital to improving IV cannulation outcomes.

Intravenous catheterization, commonly through peripheral intravenous cannulas, is a core nursing skill essential for administering fluids, medications, nutrition, blood products, and imaging agents (Dougherty, 2020; Weinstein, 2022; Abd El Rassol & Abdelaziz, 2023). Despite being routine, IV cannulation poses risks such as phlebitis, infiltration, catheter-related bloodstream infections, septicemia, and embolism (Mermel, 2017; Hadaway, 2012). Proper site selection is critical, with veins of the hand and forearm preferred, while veins in the lower extremities or unsuitable sites such as flexion zones

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and sclerosed veins should be avoided due to heightened infection risk (Arbaee & Mohd Ghazali, 2012; O'Grady et al., 2006). Although many patients experience uneventful IV therapy, complications can lead to prolonged hospitalization, increased financial burden, and in severe cases, disability (Scales, 2008; Abd El Rassol & Abdelaziz, 2023).

Pediatric patients present distinct challenges for IV therapy because of delicate anatomy, small veins, high activity levels, and limited ability to express discomfort (Zingg & Pittet, 2009; Mohamed et al., 2020). These factors contribute to frequent cannulation failures, caregiver difficulties, and higher complication risks. Guidelines from the Infusion Nurses Society (INS, 2021), CDC (2011), and others stress aseptic insertion, routine site assessment, and timely recognition of complications (O'Grady et al., 2011; Jackson, 2021; Macklin, 2019). However, adherence varies widely due to systemic barriers such as high workloads, skill degradation, inadequate training, and absence of pediatric-specific protocols (Rickard et al., 2012; Marsh et al., 2015). Reported IV catheter failure rates of up to 69% emphasize the urgency of addressing these issues through evidence-based practice, competency-based training, and institutional support (Helm et al., 2015; Alexandrou et al., 2018; Chopra et al., 2014; Rickard & Ray-Barruel, 2017). This study therefore seeks to evaluate pediatric nurses' knowledge, practices, and barriers in IV cannulation care to enhance safety and outcomes.

1. Materials and Methods

1.1 Research Design and Setting

A descriptive cross-sectional study design was adopted and conducted at a tertiary care hospital in Lahore. The hospital consists of multiple inpatient departments, including medical, surgical, emergency, and intensive care units, making it an ideal setting to capture diverse nursing practices and experiences where intravenous (IV) cannulation is routinely performed.

2.2 Target Population and Eligibility Criteria

The study population included registered nurses (RNs) directly involved in patient care across different departments of the children's hospital. Inclusion criteria specified nurses with a minimum of six months of clinical experience, those actively engaged in IV cannula insertion and maintenance, and those who provided informed consent. Exclusion criteria included nursing interns, students, administrative staff, outpatient care providers, nurses on long-term leave, and those who declined participation.

2.3 Sample Size and Sampling Technique

The minimum required sample size was calculated as 150 participants. A stratified random sampling technique was applied, whereby nurses were stratified based on departments such as ICU, surgery, and medicine. Proportional allocation ensured adequate representation from each unit, and participants were randomly selected within each stratum.

2.4 Data Collection Tool

Data were collected using a structured self-administered questionnaire developed from existing literature and validated instruments (INS, 2021; Ray-Barruel et al., 2019; Marsh et al., 2020; Arbaee, 2019). The tool comprised five sections: demographic data (age, gender, education, designation, clinical experience, and department), knowledge assessment, practice assessment, barriers to IV cannulation care, and additional feedback. Knowledge was assessed through multiple-choice and true/false items, practice through self-reports and observation checklists, and barriers via a Likert-scale survey exploring institutional and personal constraints.

2.5 Data Collection Procedure

Ethical approval was obtained from the Institutional Review Board of the tertiary care hospital. Written informed consent was secured from all participants prior to enrollment. Questionnaires were distributed in person during break hours to minimize disruption of duties. Data were collected across all shifts (morning, evening, and night) over a four-week period. Confidentiality and anonymity of participants were strictly maintained throughout the study.

2.6 Data Analysis

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Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics such as frequencies and means were used to summarize demographic data and knowledge/practice scores. Inferential statistics included Chi-square tests to determine associations between demographic variables and knowledge or practice scores, and independent t-tests/ANOVA to compare mean scores across different groups (e.g., departments, years of experience).

2. Results

Table 1: Demographic Characteristics of Participants (N = 150)

Variable	Category	Frequency
Age (years)	22–25	24
	26–29	32
	30–33	45
	34–37	21
	>38	28
Qualification	Diploma in Nursing	14
	Diploma in Nursing + Specialization	26
	BSN	43
	Post RN	67
Designation	Staff Nurse	112
	Senior Staff Nurse	38
Experience (years)	0–2 years	88
	3–5 years	48
	6–10 years	10
	>10 years	4
Department	General Medical Ward	25
	General Surgical Ward	16
	Intensive Care Unit (ICU)	23
	Nursery ICU + Nursery	67
	Others (Dermatology, Ortho, Oncology, etc.)	19

Table 1 presents the demographic characteristics of the 150 participating nurses. The largest age group was 30–33 years (45 nurses), followed by 26–29 years (32 nurses). In terms of qualifications, most held a Post RN degree (67), while 43 had a BSN, 26 a diploma with specialization, and 14 a diploma only. The majority were staff nurses (112), with 38 serving as senior staff nurses. Regarding experience, most had 0–2 years (88) or 3–5 years (48), while only 14 had over 6 years. Department-wise, most participants worked in the Nursery ICU and nursery (67), followed by the medical ward (25), ICU (23), surgical ward (16), and other specialties (19).

Table 2: Department vs. Practice Level of Nurses (N = 150)

Department	Good Practice	Poor Practice	Total
General Medical Ward	17	8	25
General Surgical Ward	10	6	16
All ICU	64	3	67
Emergency	22	1	23
Others	9	10	19
Total	**122**	**28**	**150**

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The table 2 shows the distribution of nursing practice levels across departments. Most nurses demonstrating good practice were from ICUs (64 out of 67) and the emergency department (22 out of 23). In contrast, a higher proportion of poor practice was observed in the "Others" category (10 out of 19). The Chi-square test revealed a statistically significant association between department and practice level ($\chi^2(3, N = 150) = 10.48$, $p = 0.015$).

Table 3: ANOVA – Years of Experience vs. Mean Knowledge Score (N = 150)

Experience Group	Mean Score	SD
0–2 years	12.4	2.1
3–5 years	13.8	1.7
6–10 years	14.3	1.4
>10 years	14.8	1.3

ANOVA Result: $F(3, 146) = 6.78$, $p = 0.0003$

The table 33 presents the mean knowledge scores of nurses across different experience groups. Nurses with greater experience tended to have higher knowledge scores, with the lowest mean score observed in the 0–2 years group (M = 12.4, SD = 2.1) and the highest among those with more than 10 years of experience (M = 14.8, SD = 1.3). ANOVA indicated a statistically significant difference in knowledge scores across the groups, $F(3, 146) = 6.78$, $p = 0.0003$, suggesting that knowledge levels improve with increased years of experience.

Table 4: Logistic Regression – Predictors of Good Knowledge (N = 150)

Predictor	Odds Ratio (OR)	95% CI	p-value
>5 years of experience	2.78	1.45 – 5.32	0.002 **
Recent training attended	3.25	1.80 – 5.86	0.001 **
High workload (barrier)	0.61	0.33 – 1.12	0.109
Department (Emergency)	1.96	1.05 – 3.66	0.036 *

The logistic regression model identified key predictors of nurses' good knowledge regarding IV cannulation. Nurses with more than five years of experience (OR = 2.78, p = 0.002) and those who attended recent training (OR = 3.25, p = 0.001) were significantly more likely to demonstrate good knowledge. Working in the emergency department also showed a positive association (OR = 1.96, p = 0.036). In contrast, high workload was negatively associated with good knowledge (OR = 0.61) but did not reach statistical significance (p = 0.109).

Table 5: Logistic Regression – Predictors of Good Practice (N = 150)

Predictor	Odds Ratio (OR)	95% CI	p-value
>5 years of experience	2.34	1.25 – 4.68	0.009 **
Training attended	2.85	1.55 – 5.26	0.001 **
Barrier: Lack of supplies	0.49	0.27 – 0.91	0.023 *
Department (ICU)	2.12	1.09 – 4.10	0.028 *

The regression model revealed significant predictors of good IV cannulation practice among nurses. Those with more than five years of experience (OR = 2.34, p = 0.009) and those who attended training (OR = 2.85, p = 0.001) were more likely to demonstrate good practice. Nurses working in ICUs also showed higher odds of good practice (OR = 2.12, p = 0.028). Conversely, lack of supplies was a significant barrier, reducing the likelihood of good practice (OR = 0.49, p = 0.023).

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3. Discussion

This study revealed that most pediatric nurses demonstrated only moderate knowledge of peripheral intravenous (PIV) cannulation, with notable gaps in recognizing complications, adhering to evidence-based dwell times, and applying international guidelines such as those from the CDC (2011) and the Infusion Nurses Society (2021). Similar deficiencies have been documented by Mohamed et al. (2020) and Huang et al. (2021), suggesting that pediatric-specific knowledge remains limited despite the frequency of IV procedures. The lack of awareness of best practices, including the Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) (Chopra et al., 2014), may contribute to preventable complications.

While many nurses reported routine inspection and some adherence to insertion standards, inconsistencies were identified in aseptic technique, flushing protocols, and documentation. These findings align with Rickard and Ray-Barruel (2017), who noted widespread deviation from international IV standards. Suboptimal practices, such as inadequate aseptic technique and poor site monitoring, have been shown to increase catheter failure and infection rates (Helm et al., 2015; Marsh et al., 2015). Even experienced nurses are at risk of skill complacency without regular reinforcement (Dougherty, 2020), emphasizing the need for simulation-based training, audits, and supportive supervision (Hassanein et al., 2021).

Nurses also reported multiple barriers to optimal practice. Organizational factors such as high workloads, insufficient staffing, and lack of supplies mirrored barriers identified by Jackson (2021a) and Kadhim and Bakey (2022). Patient-related challenges—including small vein size, movement, and uncooperative behavior—were consistent with the difficulties described in pediatric contexts (Taşdelen et al., 2024). Additionally, limited training opportunities and low self-confidence, highlighted in previous studies (Urbanetto et al., 2016; Macklin, 2019a), further restrict nurses' ability to maintain safe practices.

The findings underscore the necessity of institutional investment in competency-based training, continuous professional development, and dissemination of pediatric-specific guidelines. Structural improvements such as adequate staffing and resource availability are equally critical. Consistent with Zingg and Pittet (2009) and CDC (2011), strengthening infection prevention policies and ensuring fidelity to IV standards can substantially reduce complications and improve patient safety.

4. Conclusion

Based on the findings, it is recommended that hospitals implement regular competency-based training and pediatric-specific protocols to strengthen nurses' knowledge and practice in IV cannulation. Additionally, addressing systemic barriers such as staffing shortages, limited supplies, and lack of institutional support is essential to ensure safe and effective pediatric IV therapy.

References

Abd El Rassol, A. M., & Abdelaziz, T. M. (2023). *Peripheral intravenous cannulation: Techniques, complications, and nursing management*. Journal of Nursing and Health Science, 12(2), 45–52.

Alexandrou, E., Ray-Barruel, G., Carr, P. J., Frost, S., Inwood, S., Higgins, N., ... & Rickard, C. M. (2018). Use of short peripheral intravenous catheters: Characteristics, management, and outcomes worldwide. *Journal of Hospital Medicine, 13*(5), 1–7. https://doi.org/10.12788/jhm.3039

Arbaee, I. F., & Mohd Ghazali, A. N. (2012). Complications related to peripheral intravenous cannulation: A review. *Malaysian Journal of Nursing, 4*(2), 22–29.

Centers for Disease Control and Prevention. (2011). *Guidelines for the prevention of intravascular catheter-related infections*. Atlanta, GA: U.S. Department of Health and Human Services.

Chopra, V., Flanders, S. A., Saint, S., Woller, S. C., O'Grady, N. P., Safdar, N., ... & Bernstein, S. J. (2014). The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results from a multispecialty panel using the RAND/UCLA appropriateness method. *Annals of Internal Medicine, 163*(6), S1–S40. https://doi.org/10.7326/M15-0744.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Dougherty, L. (2020). *Peripheral intravenous therapy: Principles and practice* (4th ed.). Wiley-Blackwell.

Hadaway, L. (2012). Short peripheral intravenous catheters and infections. *Journal of Infusion Nursing, 35*(4), 230–240. https://doi.org/10.1097/NAN.0b013e31825af099.

Hassanein, S. M., Elaziz, K. M. A., & Hussein, R. S. (2021). Effect of simulation-based training on nurses' performance regarding intravenous therapy. *Egyptian Nursing Journal, 18*(3), 220–229. https://doi.org/10.4103/enj.enj_25_21

Helm, R. E., Klausner, J. D., Klemperer, J. D., Flint, L. M., & Huang, E. (2015). Accepted but unacceptable: Peripheral IV catheter failure. *Journal of Infusion Nursing, 38*(3), 189–203. https://doi.org/10.1097/NAN.0000000000000100.

Huang, L., Tian, S., Chen, L., & Liu, Y. (2021). Pediatric nurses' knowledge and practice regarding peripheral intravenous therapy. *Journal of Pediatric Nursing, 56*, e45–e52. https://doi.org/10.1016/j.pedn.2020.12.004.

Indarwati, F., Mathew, S., & Chaboyer, W. (2022). Strategies to improve nurses' adherence to evidence-based guidelines in peripheral intravenous catheter care: An integrative review. *Journal of Clinical Nursing, 31*(1-2), 10–22. https://doi.org/10.1111/jocn.15946.

Infusion Nurses Society. (2021). *Infusion therapy standards of practice. Journal of Infusion Nursing, 44*(1S), S1–S224. https://doi.org/10.1097/NAN.0000000000000396.

Jackson, A. (2021a). Barriers to safe intravenous therapy: Perspectives from pediatric nurses. *Nursing Children and Young People, 33*(4), 18–24. https://doi.org/10.7748/ncyp.2021.e1322.

Kadhim, M. J., & Bakey, S. (2022). Challenges facing nurses in implementing infection control measures in pediatric units. *Iraqi Journal of Nursing Specialties, 35*(2), 45–53.

Macklin, D. (2019). Catheter-related complications: Reducing risk with evidence-based practice. *British Journal of Nursing, 28*(8), S4–S12. https://doi.org/10.12968/bjon.2019.28.8.S4.

Marsh, N., Webster, J., Mihala, G., & Rickard, C. M. (2015). Devices and dressings to secure peripheral venous catheters: A Cochrane systematic review and meta-analysis. *International Journal of Nursing Studies, 52*(5), 823–835. https://doi.org/10.1016/j.ijnurstu.2014.12.006.

Mermel, L. A. (2017). Short-term peripheral venous catheter-related bloodstream infections: A systematic review. *Clinical Infectious Diseases, 65*(10), 1757–1762. https://doi.org/10.1093/cid/cix562.

Mohamed, N. I., Ahmed, S. M., & Tawfik, A. H. (2020). Knowledge and practice of nurses regarding intravenous cannulation and maintenance in pediatric patients. *Egyptian Journal of Health Care, 11*(2), 367–381.

O'Grady, N. P., Alexander, M., Burns, L. A., Dellinger, E. P., Garland, J., Heard, S. O., ... & Saint, S. (2011). Guidelines for the prevention of intravascular catheter-related infections. *Clinical Infectious Diseases, 52*(9), e162–e193. https://doi.org/10.1093/cid/cir257.

Osti, C., Wosti, D., Pandey, B., & Zhao, Q. (2019). Knowledge and practice towards care and maintenance of peripheral intravenous cannula among nurses in Chitwan Medical College Teaching Hospital, Nepal. *Nursing Open, 6*(3), 1006–1012. https://doi.org/10.1002/nop2.282.

Rickard, C. M., & Ray-Barruel, G. (2017). Peripheral intravenous catheter assessment: Beyond phlebitis. *Journal of Infusion Nursing, 40*(6), 366–372. https://doi.org/10.1097/NAN.0000000000000245.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Rickard, C. M., Webster, J., Wallis, M. C., Marsh, N., McGrail, M. R., French, V., ... & Whitby, M. (2012). Routine versus clinically indicated replacement of peripheral intravenous catheters: A randomized controlled equivalence trial. *The Lancet, 380*(9847), 1066–1074. https://doi.org/10.1016/S0140-6736(12)61082-4.

Scales, K. (2008). Reducing the risk of infection associated with vascular access devices. *Nursing Standard, 22*(43), 41–47. https://doi.org/10.7748/ns2008.07.22.43.41.c6590.

Taşdelen, E., Yildiz, D., & Aydin, R. (2024). Challenges in pediatric intravenous cannulation: Nurses' perspectives. Pediatric Nursing Journal, 36(1), 12–20.

Urbanetto, J. S., Rodrigues, A. B., & Nobre, I. (2016). Self-confidence and training needs of nurses regarding intravenous therapy in children. Revista Latino-Americana de Enfermagem, 24, e2815. https://doi.org/10.1590/1518-8345.1057.2815.

Weinstein, S. M. (2022). *Plumer's principles and practice of infusion therapy* (10th ed.). Wolters Kluwer Health.

Zingg, W., & Pittet, D. (2009). Peripheral venous catheters: An under-evaluated problem. *International Journal of Antimicrobial Agents, 34*(S4), S38–S42. https://doi.org/10.1016/S0924-8579(09)70565-5.