

A Study to Develop a Planned Teaching Programme and Demonstration on Intravenous Cannulization for Staff Nurses and Assess Its Effectiveness in Terms of Gaining Knowledge and Practice at Selected Hospital in Delhi, India

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Abstract

Introduction: Intravenous cannulization is a fundamental skill for staff nurses, crucial for effective patient care and treatment delivery. Despite its importance, variations in technique and knowledge gaps can impact patient outcomes and safety. This study addresses this need by developing a structured educational program specifically designed to improve the knowledge and practical skills of nursing staff in intravenous cannulization. **Objectives** of the study were: a) To assess the knowledge of staff nurses regarding intravenous cannulization; b) To assess the staff nurse's practice regarding intravenous cannulization; c) To develop a planned teaching programme and demonstration on intravenous cannulization; and d) To assess the effectiveness of the planned teaching programme and demonstration on knowledge and practice. **Method:** The research method chosen for this study was a quantitative research approach. A pre-experimental one-group post-test research design was used; and selected 42 staff nurses by the convenient sampling technique in the selected Hospital, New Delhi; self-structured knowledge questionnaire, and practice observation checklist was used. **Result:** The mean pre-test knowledge scores of staff nurses on intravenous cannulisation is 22.90. The standard deviation is 4.230. The mean post-test knowledge score is 30.714. The standard deviation is 3.33, which indicates that there was a significant gain in the knowledge of staff nurses on intravenous cannulization. The mean post-test practice score (39.84) was higher than the mean pre-test practice score (21.56). The mean difference (18.28) is statistically significant, as evidenced by a 'z' value of 7.77 ($p < 0.05$). The 'z' value of 7.77 exceeds the critical value of 2.0 at the 0.05 level of significance, demonstrating that the planned teaching program was effective in enhancing the staff nurses' knowledge of intravenous cannulization.

Keywords: Knowledge, practice, staff nurse, planned teaching program, intravenous cannulization, effectiveness, Delhi

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INTRODUCTION

Intravenous cannulization is a common procedure for patients in clinical environments, with about 90% of inpatients undergoing IV infusion therapy as part of their care. Proper venous access requires a skilled practitioner, as the procedure can be quite challenging initially. Nurses are dedicated to performing, overseeing, and managing IV infusions with expertise to ensure patient safety and maintain high standards of care [1]. Each year, around 25 million people globally receive intravenous treatment through IV cannulization [2].

It is essential to use sterile techniques during the IV cannulization process because it involves accessing the patient's vein. This procedure can be a common source of infection due to the migration of skin flora from the insertion site into the patient's bloodstream [3, 4]. As a result, it is crucial for healthcare professionals, especially nurses who frequently handle IV cannulas in hospitals, to have a solid understanding, receive comprehensive training, and acquire hands-on experience in properly inserting these devices [5].

A significant number of deaths are attributed to bloodstream infections, with about 1 in 10 individuals suffering from a type of life-threatening hepatitis. These issues often arise from inadequate intravenous cannulization or therapy practices [6]. Additionally, complications from IV cannulization can be both mechanical and infectious. Mechanical issues include problems like occlusion, thrombosis, dislodgment, infiltration, leakage, phlebitis, and scar formation. Infectious complications encompass fungal and bacterial sepsis [7].

The study revealed that 11% of staff nurses had poor knowledge (scores ranging from 0–5) about the prevention and management of local complications related to peripheral intravenous therapy. In terms of practices, 3% of staff nurses demonstrated poor practices (scores ranging from 0–6) in the same area. Additionally, only 34% of the staff nurses washed their hands before performing cannulization. Only 5% of the staff nurses used sterile gloves during the cannulization procedure. A mere 7% adhered to the appropriate INS guidelines for cannula insertion, and the same percentage utilized aseptic techniques during the process. Just 9% checked and replaced the Intracath dressing when it became soiled. Only 1% provided patient education on recognizing and reporting early signs of complications. Additionally, only 5% removed the IV cannula after 72 h regardless of any complications. 16% of the staff flushed the Intracath before and after IV injections, while just 3% were assessed for complications every 6 h using a visual grading scale. In the case of phlebitis, 15% applied warm moist compresses, and 20% used sterile dressings after careful inspection for infiltration. Only 17% applied a cold compress followed by a warm compress for thrombophlebitis [8].

Sharma *et al.* conducted a descriptive study to assess staff nurses' knowledge and practices regarding cannulization. Data were collected using a self-structured questionnaire and an observational checklist. The findings predominantly indicated that nurses had inadequate knowledge and poor practices concerning cannulization [9].

Selvi conducted a descriptive study to assess the knowledge and practice of nurses regarding intravenous therapy using nonprobability convenient sampling technique; 52 staff nurses were assessed using structured knowledge questionnaire, observational checklist, and the results showed that 54% had inadequate knowledge, and 67% had low satisfactory practice regarding IV therapy [10].

RESEARCH METHODOLOGY

A quantitative approach was used for this study.

Research design

A pre-experimental one-group post-test research design.

Sample

Staff who are working in the medical, surgical, and critical departments of the selected hospital, Delhi.

Sample size

48 staff nurses registered under INC, who met the inclusion criteria.

Sampling technique

Non-probability Convenience sampling techniques were used.

Table 1. Socio-demographic profile of the sample (N=42).

Demographic Variable	Categories	Frequency	Percentage (%)
Age (years)	18–28	32	76.19
	29–38	4	9.52
	39–49	2	1.76
	50–69	1	2.38
Gender	Female	100	100
	Male	0	0
Educational Qualification	GNM	38	90.47
	BSc	3	7.14
	Post BSc	1	2.38
Experience (years)	<1 year	3	7.14
	1–5 years	35	83.33
	6–10 years	2	4.76
	11–15 years	0	0
	16–20 years	1	2.38
	21–25 years	1	2.38
Clinical Area	Medical	30	71.42
	Surgical	20	47.61
	Obs and Gynae	4	9.52
	Paediatric	5	11.90
In Service Education	Yes	33	78.57
	No	9	21.42

Data Collection Tool

- *Part 1:* Demographic and Clinical data which includes age, gender, professional qualification, year of experience, and participation in the CNE program.
- *Part 2:* Self-structured questionnaire and Observational Checklist. The structured questionnaire consisted of 35 questions regarding the anatomical and physiological aspects of IV cannulization. The observational checklist consisted of 25 items to evaluate their skill performance on Intravenous cannulization.

Data analysis was done with inferential and descriptive statistics.

RESULTS

The demographic profile of the subjects is mentioned in Table 1.

Table 1 provides detailed demographic information about the staff nurses.

- *Age:* The majority of the nurses are relatively young, with 76.19% in the 18–28 year age group. A smaller percentage are in the 29–38 year age (9.52%), and even fewer are in the 39–49 year range (1.76%). Only a small number fall into the 50–69 year category (2.38%).
- *Gender:* All the nurses in the sample are females, (100%).
- *Educational Qualification:* Most nurses have completed a General Nursing and Midwifery (GNM) program (90.47%). A smaller percentage hold a Bachelor of Science in Nursing (BSc) degree (7.14%), and even fewer have a Post BSc qualification (2.38%).
- *Experience (years):* The majority of nurses have between 1 and 5 years of professional experience (83.33%). A small number have less than 1 year (7.14%), or between 6 and 10 years (4.76%) of experience. There are minimal representations for those with 11–15 years, 16–20 years (2.38%), and 21–25 years (2.38%) of experience.

- *Department:* Nurses predominantly work in medical (71.42%) and surgical departments (47.61%). A smaller portion of the population works in obstetrics and gynaecology (9.52%) and paediatrics (11.90%).
- *In-Service Education:* The majority of nurses have participated in in-service education programs (78.57%), indicating a commitment to ongoing professional development, while a minority have not engaged in such educational activities (21.42%).

Table 2 shows that the mean post-test knowledge score (30.771) was higher than the mean pre-test knowledge score (22.90), indicating a significant improvement in the staff nurses' knowledge of intravenous cannulization. The mean difference is statistically significant, as evidenced by a 'z' value of 9.46 ($p < 0.05$). The 'z' value of 9.46 exceeds the critical value of 2.0 at the 0.05 significance level, demonstrating that the planned teaching program effectively enhanced the staff nurses' knowledge of intravenous cannulization (Figure 1).

Table 3 shows that (17) 40.47% performed washing hands. Proper hand hygiene is critical to preventing infection. A majority i.e. (25) 59.53% skipped this step, which increases the risk of contaminating the procedure site. (19) 45.23% ensured that all necessary equipment is at hand before starting, which helps streamline the procedure. (23) 54.77% failed to do this, potentially causing delays or interruptions during the procedure. (17) 40% of staff nurses positioned the patient properly as this enhances comfort and procedural effectiveness. More than half i.e. (25) 60% of staff nurses did not ensure patient comfort, which could affect the patient's experience and the procedure's success. (8) 20% communicated clearly about the procedure as this is crucial for patient understanding and cooperation. Most of the nurses (34) 80% did not explain the procedure, potentially leading to patient anxiety and lack of cooperation. (15) 36% of staff nurses chose the right site for the procedure as this is essential for successful IV cannulization; more than half i.e., (27) 64% did not select an appropriate site, which can affect the procedure's effectiveness. Only (9) 21.42% of staff nurses remove hair to help prevent contamination and improve access to the site.

Table 2. Mean, mean difference median, range, standard deviation, and “z” value of pre-test and post-test knowledge scores (N=42).

Knowledge test	Mean	Mean difference	Median	SD	SEM	'z'
Pre-test knowledge score	22.90	7.27	24.23	4.230	0.65271	9.46
Post-test knowledge score	30.771		31.74	3.33	0.51492	

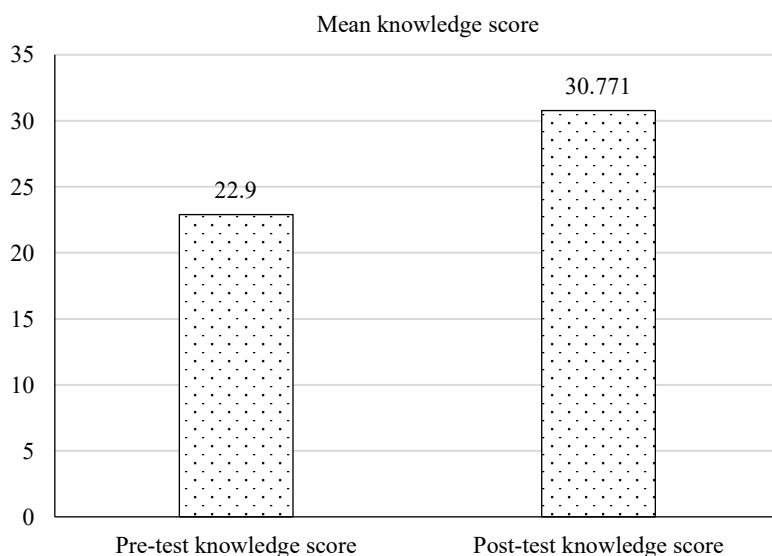


Figure 1. Bar chart comparing knowledge scores from Pre-test and Post-test.

Table 3. Frequency and percentage of practice among staff nurses on intravenous cannulization before planned teaching program (N=42).

S.N.	Step of procedure	Frequency	Percentage	Frequency	Percentage
		<i>Performed</i>		<i>Not Performed</i>	
	Washes hands before the procedure	17	40.47	25	59.53
	Gathers all the equipment to the bedside	19	45.23	23	54.77
1.	Positions the patient comfortably	17	40	25	60
2.	Explains the procedure to the patient	8	20	34	80
3.	Selects the suitable site for IV cannulization	15	36	27	64
4.	Removes hair, if needed	9	21.42	33	78.58
5.	Places protective towel and mackintosh under the arm	0	0	42	100
6.	Cuts pieces of adhesive tape before the procedure	12	30	30	70
7.	Uses the handrub/sanitizer	3	7.14	39	92.86
8.	Applies the tourniquet and asks the patient to close the fist.	42	100	0	0
9.	Puts on gloves	0	0	42	100
10.	Cleans the site with an alcohol swab in one stroke for 30 sec at 2–4” diameter and discards in the kidney basin	2	4.14	40	95.86
11.	Holds the cannula with the bevel upward and inserts at a 30° angle	13	30.6	29	69.4
12.	Advances needle in the vein ensuring the backflow of blood	42	100	0	0
13.	Release the tourniquet, and apply the thumb pressure at the tip of the cannula.	42	100	0	0
14.	Removes the stilette when the cannula is completely inserted.	42	100	0	0
15.	Do not reinsert stilette into cannula once withdrawn.	20	47.62	22	52.38
16.	Flushes with 2 ml of 0.9% normal saline to check the patency of counter puncture.	38	90.47	4	9.53
17.	Applies the adhesive to fix the cannula.	42	100	0	0
18.	Removes the towel and mackintosh	0	0	42	100
19.	Marks the date and time of cannulization on the adhesive tape.	38	92.00	4	8
20.	Makes the patient comfortable	24	57.14	18	42.86
21.	Discards the waste as per hospital protocol i.e., all the cotton swabs discarded in the yellow bin, syringes in the red bin, needles in a sharp container, and paper bags in the black bin.	42	100	0	0
22.	Washes hand.	24	57.14	18	42.86
23.	Documents of the procedure.'	42	100	0	0

More than half of staff nurses and (33) 78.58% skipped this step, which might complicate the procedure or increase infection risk. None of the staff nurses used towels or mackintoshes to protect the linen, with 0% adherence to this practice, while all (42) 100% failed to perform this step, potentially compromising cleanliness and patient safety. (12) 30% prepare adhesive tape beforehand, to secure the cannula properly; more than half (30) 70% did not prepare the tape beforehand, which can delay or complicate the securing of the cannula. (3) 7.14% used hand sanitizer which helps maintain hand hygiene between steps.

Table 4. Mean, Mean difference and SD, SE, Z TEST of practice on Intravenous cannulization (N=42).

Variables	Mean	Mean difference	SD	SE	Z TEST
Pre-test practice on Intravenous cannulization.	21.56	18.28	12.85	1.98	7.77
Post test practice on Intravenous cannulization.	39.84		8.20	1.26	

A majority i.e. (39) 92.86% did not use hand sanitizer, increasing the risk of infection. A majority (42) 100% applied a tourniquet and had the patient close their fist, which helps engorge veins, making them easier to access. (42) 100% did not use gloves, which could significantly increase the risk of infection. (2) 4.14% of staff nurses cleaned the site with an alcohol swab in one stroke for 30 sec at 2–4” diameter and discards in the kidney basin, majority (40) 95.86% did not follow this step, compromising sterility and patient safety. (13) 30.6% of staff nurses held the cannula with the bevel upward and inserted at a 30° angle, but many (29) 69.4% did not adhere to this technique, affecting the efficacy of the procedure. The majority of staff nurses (42) 100% confirmed the blood backflow which ensures that the needle is correctly placed in the vein. (42) 100% released the tourniquet and applied pressure, which stabilizes the cannula and prevents bleeding. (42) 100% removed the stiletto, which is necessary to complete the insertion of the cannula. (20) 47.62% ensured that the stilette is not reinserted which prevents contamination and damage to the cannula. More than half (22) 52.38% did not adhere to this practice, which could compromise the cannula's integrity. The majority (38) 90.47% flushed the cannula with saline which ensures that cannula is patent and functioning correctly; (4) 9.53% did not follow this procedure, which could affect the procedure's success. All the staff nurses (42) 100% secured the cannula with adhesive which ensures that it remains in place and functions properly. The majority (38) 92.00% performed the documentation of the date and time which is essential for tracking and managing IV therapy; but (4) 8% did not perform this step, which could impact record-keeping. More than half (24) 57.14% ensured that patient comfort is important for their overall experience and cooperation; but (18) 42.86% did not, potentially affecting patient satisfaction. The majority performed (42) 100% proper waste disposal as it is critical for infection control and safety. More than half (24) 57.14% performed hand washing after the procedure which helps prevent cross-contamination. (18) 42.86% did not wash hands after the procedure, potentially increasing infection risk. Majority performed (42) 100% accurate documentation which ensures proper record-keeping and continuity of care.

Table 4 shows that the mean post-test knowledge score (39.84) was higher than the mean pre-test knowledge score (21.56), indicating a significant improvement in the staff nurses' practice of intravenous cannulization. The mean difference (18.28) is statistically significant, as evidenced by a 'z' value of 7.77 ($p < 0.05$). The 'z' value of 7.77 exceeds the critical value of 2.0 at the 0.05 significance level, demonstrating that the planned teaching program effectively enhanced the staff nurses' knowledge of intravenous cannulization.

DISCUSSION AND CONCLUSION

The study results reveal that staff nurses' mean pre-test knowledge score on intravenous cannulisation was 22.90 with a standard deviation of 4.23. After the planned teaching program, the mean post-test knowledge score increased to 30.71, with a standard deviation of 3.33, indicating a significant improvement in knowledge. The mean pre-test practical score was 36.72 with a standard deviation of 38.45, the practices were initially significantly below optimal levels [11]. After the demonstration of the post-test, the mean practical score rose to 39.84, reflecting a notable enhancement in practice. The statistical analysis supports these findings; for knowledge, the z-value of 9.46 surpasses the table value of 2.00 at the 0.05 significance level, and the practical z-value of 7.77 ($p < 0.05$) confirms that the observed improvements in both knowledge and practice are significant [12]. Thus, the teaching program and demonstration effectively enhanced the staff nurse's knowledge and practical skills in intravenous cannulisation. suggests these findings align with previous studies, which also reported similar results. For instance, one study concluded that post-test results showed 56.67% of subjects achieved a good level of knowledge on intravenous cannulization, while 43.33% had an average level, with no subjects

falling into the poor knowledge category. Furthermore, 95% of subjects demonstrated satisfactory practice levels post-test, in contrast to 5% with unsatisfactory practice. The mean pre-test knowledge score increased from 15.28 to 26.58 post-test, and the mean practice score improved from 7.61 to 13.76. Student's paired t-test indicated a calculated t-value of 35.51 for knowledge and 23.44 for practice, demonstrating that the lecture and demonstration significantly enhanced both the knowledge and practice of intravenous cannulization among the subjects [13]. A total of 412 nurses participated in the study, achieving a response rate of 97.4%. Initially, 45.1% of the participants exhibited poor knowledge, and 46.6% demonstrated poor practice related to intravenous cannulization [14].

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