
EFFECTIVENESS OF A STRUCTURED TRAINING PROTOCOL ON NURSES' KNOWLEDGE AND CLINICAL PRACTICE IN INTRAVENOUS CHEMOTHERAPY ADMINISTRATION

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Abstract

Background: Intravenous chemotherapy is a high-risk clinical procedure that requires nurses to integrate pharmacological knowledge, accurate patient and treatment verification, safe handling of cytotoxic agents, vascular-access assessment, monitoring, management of adverse effects, and patient education. Inconsistent knowledge or practice can compromise occupational safety and patient outcomes. This study evaluated whether a structured training protocol could improve nurses' knowledge and clinical practice related to intravenous administration of chemotherapeutic agents.

Methods: A quantitative controlled pretest–posttest efficacy design was used. The planned sample was 168 nurses (84 per group); complete data were available for 160 nurses, with 80 participants each in the control and experimental groups. Participants were nurses involved in intravenous chemotherapy administration. Knowledge was assessed with a 20-item structured questionnaire and practice with an 86-point observational scale. The experimental group received a structured training protocol of approximately 35–45 minutes with reinforcement, while the control group continued routine practice. Assessments were undertaken at baseline, one month, and three months.

Results: Baseline scores were comparable. Mean knowledge was 9.97 ± 2.06 in the control group and 10.16 ± 2.11 in the experimental group ($p=0.57$). At one month, scores were

10.55±2.08 and 12.62±2.03, respectively ($p<0.01$); at three months they were 10.76±2.15 and 20.52±1.37 ($p<0.01$). Baseline practice scores were 14.48±2.63 and 14.35±2.36 ($p=0.72$). At one month, practice increased to 14.80±2.61 versus 18.83±2.71 ($p<0.01$), and at three months to 15.25±2.62 versus 33.10±3.23 ($p<0.01$). At endline, 92.5% of experimental participants were categorized as having good practice, compared with none in the control group. Knowledge and practice were positively correlated ($r=0.732$, $p<0.01$).

Conclusion: The structured training protocol produced substantial and sustained improvements in nurses' chemotherapy-related knowledge and observed clinical practice. Periodic competency-based education, reinforcement, and standardized protocols may strengthen safe chemotherapy administration.

Keywords: chemotherapy; intravenous administration; oncology nursing; training protocol; knowledge; clinical practice; nursing education.

INTRODUCTION

Chemotherapy remains a major modality in cancer treatment and may be used with curative, disease-control, neoadjuvant, adjuvant, or palliative intent. Unlike many routine medications, cytotoxic agents have a narrow margin for error and can cause significant harm when preparation, handling, administration, monitoring, or disposal is inconsistent. Intravenous chemotherapy is especially demanding because the nurse must confirm the patient and prescribed regimen, evaluate laboratory and clinical readiness, ensure the correct route and dilution, assess venous access, maintain asepsis, observe for infusion reactions or extravasation, and provide appropriate education before discharge. The source thesis emphasizes that chemotherapy administration is a major responsibility of registered nurses and that competence requires knowledge of pharmacology, dosage, preparation, administration, toxicity, and complication management. It also identifies work pressure, inadequate facilities, insufficient in-service education, and gaps in knowledge and practice as barriers to safe care.

Safe chemotherapy administration is therefore not simply a technical skill; it is a coordinated nursing process extending from pre-treatment verification to post-treatment monitoring. Standard protocols, checklists, and operating procedures can reduce variation and support consistent decision-making. The training protocol developed in the source study addressed patient and treatment identification, preparation of equipment and environment, self-protection, administration technique, observation during therapy, nursing care, complication management, cytotoxic safety, and patient/family education. Its purpose was to provide a consistent approach to intravenous chemotherapy and reduce preventable complications.

Previous studies summarized in the thesis show recurring educational needs among oncology nurses. Shrestha and Lama reported marked improvement in knowledge after an educational intervention on safe handling of cytotoxic drugs. Kermani and colleagues similarly found significant gains after a short educational course. Mishra and colleagues reported improvement in both knowledge and practice following structured teaching. Other studies identified inadequate formal oncology training, inconsistent protective practices, and the need for continuing education. These findings support competency-based interventions that combine

theoretical learning with observable clinical performance rather than relying on knowledge assessment alone.

The objective was to determine the effectiveness of a structured training protocol in improving nurses' knowledge and clinical practice regarding intravenous chemotherapy administration, and to compare outcomes between experimental and control groups at baseline, one month, and three months.

METHODOLOGY

A quantitative controlled pretest–posttest efficacy design was adopted. The study was implemented in two broad phases: development and validation of the training protocol, followed by evaluation of its efficacy. The target population comprised nurses who administered intravenous chemotherapeutic agents. Nurses willing to participate, available during data collection, and involved in chemotherapy administration were eligible. Nurses receiving chemotherapy themselves were excluded.

The planned sample comprised 168 nurses, with 84 allocated to each group based on the study's sample-size calculation and allowance for attrition. Complete outcome data were reported for 160 participants (80 control and 80 experimental). The thesis describes computer-generated randomization and also describes cluster-based organization for training delivery. Baseline characteristics demonstrated group comparability: most participants were aged 21–30 years, three-fourths were female, the majority held GNM qualifications, and most had one to three years of work experience.

Three tools were used: a demographic information sheet; a 20-item structured knowledge questionnaire with scores ranging from 0 to 20; and an observational practice scale with a maximum score of 86. The knowledge tool had reported reliability of $r=0.8$ and the observational scale $r=0.9$. Non-participant observation was used for practice assessment. The experimental group received the structured intravenous chemotherapy training protocol for approximately 35–45 minutes, followed by reinforcement. The control group did not receive the protocol during the study assessment period. Knowledge and practice were measured at baseline, one month, and three months.

Descriptive statistics included frequency, percentage, mean, and standard deviation. Between-group comparisons used inferential tests reported in the thesis, including *t* tests and chi-square tests; correlation analysis examined the relationship between knowledge and practice. Statistical significance was considered at $p<0.05$. Ethical approval was obtained from an Institutional Ethics Committee. Informed consent, confidentiality, and anonymity were maintained.

RESULTS

Complete data from 160 nurses were analyzed, with 80 participants in each group. The groups were similar at baseline. In the control and experimental groups, respectively, 75.0% and 71.3% were aged 21–30 years; 76.3% and 73.8% were female; 92.5% and 88.8% held GNM qualifications; and 77.5% and 75.0% had one to three years of work experience. Baseline knowledge classification was identical in the two groups: 88.8% had average knowledge and

11.3% had poor knowledge, with no participant classified as good. These findings support baseline comparability before the intervention.

Table 1. Knowledge scores by group and assessment point

Assessment	Control Mean±SD	Experimental Mean±SD	Mean difference	t	p
Baseline	9.97±2.06	10.16±2.11	-0.18	-0.56	0.57
1 month	10.55±2.08	12.62±2.03	-2.07	-6.37	<0.01
3 months	10.76±2.15	20.52±1.37	-9.76	-34.15	<0.01

Knowledge improved substantially after training. At baseline there was no statistically significant difference between groups. By one month, the experimental group mean had increased to 12.62 compared with 10.55 in the control group. At three months, the experimental mean reached 20.52 compared with 10.76 in the control group, producing a large between-group difference. The thesis expressed the experimental group's knowledge as increasing from 46.19% at baseline to 93.29% at endline, with an improvement of 47.10 percentage points, while the control group changed only modestly.

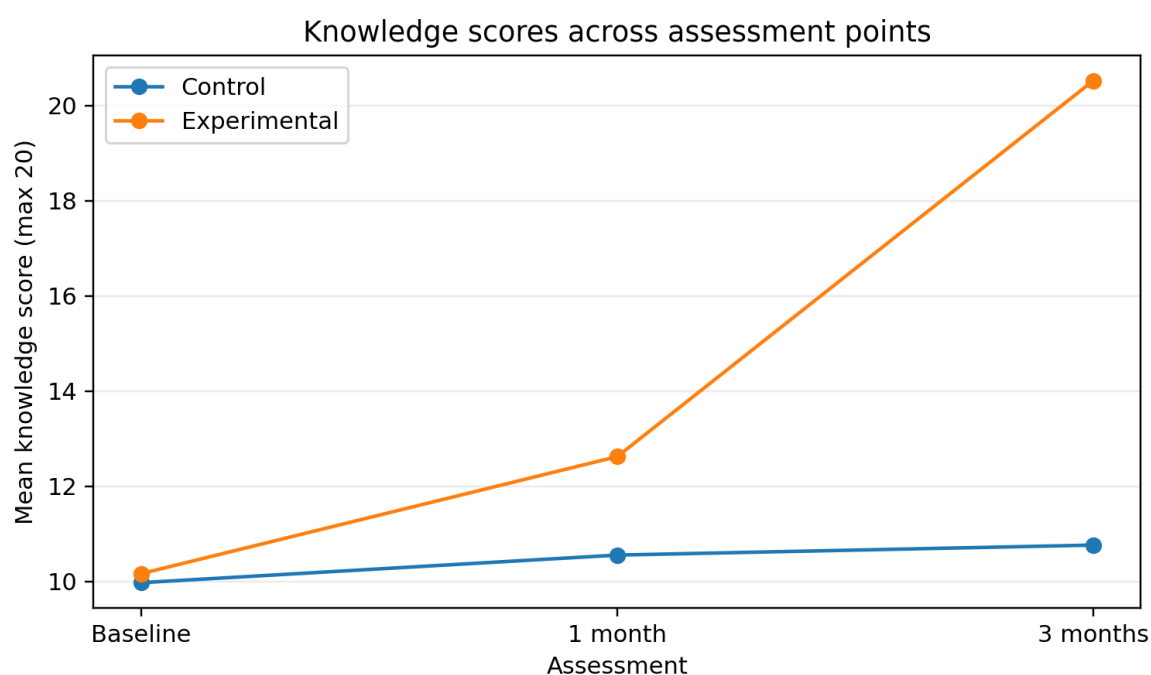


Figure 1. Mean knowledge scores at baseline, one month, and three months.

Table 2. Practice scores by group and assessment point

Assessment	Control Mean±SD	Experimental Mean±SD	Mean difference	t	p
Baseline	14.48±2.63	14.35±2.36	0.13	0.34	0.72
1 month	14.80±2.61	18.83±2.71	-4.03	-9.58	<0.01
3 months	15.25±2.62	33.10±3.23	-17.85	-38.28	<0.01

Practice showed a parallel pattern. Baseline practice scores did not differ significantly. At one

month, the experimental group mean rose to 18.83 compared with 14.80 in controls. At three months, the experimental mean was 33.10 versus 15.25 in controls. The thesis reported experimental practice improvement from 33.37% of the scale at baseline to 76.97% at endline, whereas the control group changed from 33.69% to 35.46%. Endline categorical assessment showed that 74 of 80 experimental participants (92.5%) achieved good practice and six (7.5%) average practice; none were poor. In the control group, none achieved good practice, 50 (62.5%) were average, and 30 (37.5%) remained poor. The between-group difference was significant ($\chi^2=138.571$, $p<0.01$). Knowledge and practice were positively correlated ($r=0.732$, $p<0.01$), indicating that higher knowledge tended to accompany better observed practice.

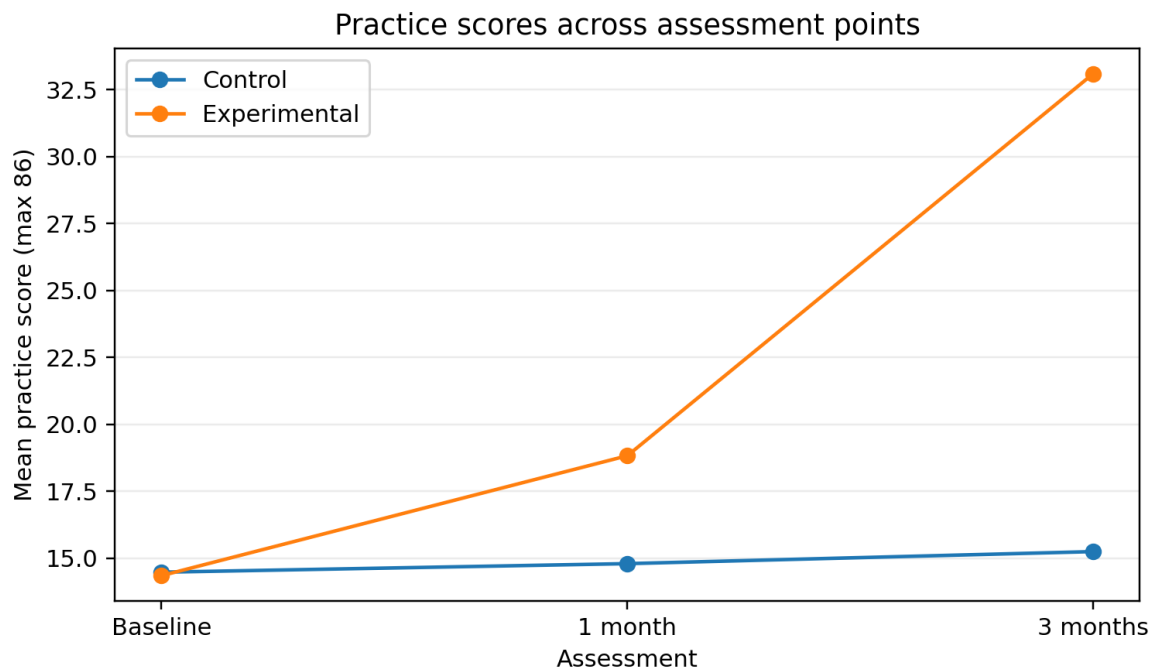


Figure 2. Mean practice scores at baseline, one month, and three months.

DISCUSSION

The findings demonstrate that a structured training protocol can produce meaningful improvements in both knowledge and observable nursing practice related to intravenous chemotherapy. The absence of significant baseline differences strengthens the interpretation that the later divergence between groups was associated with the educational intervention rather than pre-existing group differences. Knowledge gains were evident at one month and became much larger by three months, while practice followed the same direction. The positive correlation between knowledge and practice further suggests that theoretical understanding and clinical performance are interdependent components of chemotherapy competency.

These findings are consistent with studies reviewed in the source thesis. Shrestha and Lama observed a substantial rise in knowledge following education on safe handling of cytotoxic drugs. Kermani et al. found that even a short educational course significantly improved nurses' knowledge and attitudes. Mishra et al. reported increases in both knowledge and practice after structured teaching. Mohsen and colleagues found improved knowledge and protective practices after implementation of a chemotherapy safety protocol. Collectively, these studies

support repeated, protocol-driven education as an effective approach for strengthening oncology nursing competence.

The magnitude of improvement in observed practice is clinically important because chemotherapy safety depends on actions performed consistently at the bedside. A nurse may know the principles of cytotoxic safety yet fail to apply them under workload pressure or in the absence of standardized cues. A structured protocol can convert abstract knowledge into a sequence of actions: verifying identity and prescription, preparing equipment and the environment, using protective measures, checking vascular access, monitoring the infusion, recognizing extravasation or adverse reactions, managing waste, and educating patients. Reinforcement may also explain why gains were greater at three months than at the first post-test.

CONCLUSION

A structured, competency-oriented training protocol was effective in improving nurses' knowledge and clinical practice regarding intravenous chemotherapy administration. Improvements were significant at one month and were more pronounced at three months, whereas the control group showed little change. Healthcare organizations providing chemotherapy should consider standardized training, periodic reinforcement, observational competency assessment, and continuing education for nurses responsible for cytotoxic drug administration. Wider multicenter evaluation is recommended before generalizing the protocol across different institutional contexts.

ETHICAL CONSIDERATIONS

Ethical approval was obtained before commencement of the study. Informed consent was obtained from participants, and confidentiality and anonymity were maintained.

CONFLICT OF INTEREST

The authors declare no conflict of interest in relation to this manuscript.

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