

*Original Article*

# Effectiveness of Educational Intervention on Safe Medication Administration Knowledge, Attitude and Practice Among Nursing Interns at Shahida Islam Teaching Hospital, Lodhran

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## ABSTRACT

**Background:** Safe medication administration is a fundamental component of nursing practice and a major determinant of patient safety. Nursing interns are particularly vulnerable to medication-related errors because of limited clinical experience, inconsistent procedural reinforcement, and transitional gaps between theoretical learning and bedside application. **Objective:** To evaluate the effectiveness of a structured educational intervention on knowledge, attitude, and practice regarding safe medication administration among nursing interns at Shahida Islam Teaching Hospital, Lodhran. **Methods:** A quasi-experimental one-group pre-test and post-test study was conducted among 34 nursing interns. Participants received a 45-minute structured educational session incorporating lecture, demonstration, and interactive discussion on the Five Rights of medication administration, patient identification, medication expiry, documentation, and error prevention. Data were collected before the intervention and one week afterward using a structured questionnaire covering knowledge, attitude, and practice domains. Data were analyzed in SPSS using descriptive statistics and paired-sample t-tests, with  $p < 0.05$  considered statistically significant. **Results:** Post-intervention scores improved across all domains. Mean knowledge score increased from  $0.52 \pm 0.14$  to  $0.80 \pm 0.10$ , attitude from  $4.02 \pm 0.09$  to  $4.54 \pm 0.12$ , and practice from  $4.18 \pm 0.08$  to  $4.66 \pm 0.10$ . Significant improvements were observed in knowledge of the Five Rights ( $p = 0.002$ ), patient identification ( $p = 0.013$ ), expiry checking ( $p = 0.004$ ) confidence in medication administration ( $p = 0.002$ ), patient verification ( $p = 0.005$ ), correct administration procedures ( $p = 0.010$ ), and documentation ( $p = 0.002$ ). Error reporting and some near-miss-related outcomes improved but did not reach statistical significance. **Conclusion:** Structured educational intervention significantly improved nursing interns' medication-safety knowledge, attitudes, and selected practice behaviors. Integration of recurring competency-based training into internship programs may strengthen clinical performance and promote safer medication administration. **Keywords:** nursing interns, safe medication administration, educational intervention, knowledge, attitude, practice, patient safety.

## INTRODUCTION

Safe medication administration is a core component of nursing practice and a major determinant of patient safety, quality of care, and clinical accountability. Medication errors remain a persistent global problem and are associated with preventable morbidity, prolonged hospital stay, increased healthcare expenditure, and avoidable mortality, particularly in systems where staffing pressures and workflow

complexity compromise adherence to standardized procedures (1). Because nurses constitute the final checkpoint before medication reaches the patient, their competence in verifying the right patient, right medication, right dose, right route, and right time is central to error prevention and safe clinical care (2). Among novice practitioners, nursing interns are especially vulnerable to medication administration errors because their transition from classroom learning to real-world practice is often marked by limited hands-on experience, incomplete confidence, variable supervision, and inconsistent familiarity with institutional medication safety protocols (3).

The burden of medication-related error is influenced not only by individual knowledge deficits but also by broader educational and workplace determinants. Evidence from contemporary nursing literature shows that gaps in medication knowledge, calculation accuracy, patient identification, expiry verification, documentation, and error reporting can directly affect clinical decision-making and safe medication practice (4). These challenges are particularly relevant during internship, when learners are expected to apply theoretical knowledge under time pressure and within hierarchical care environments. In such circumstances, inadequate reinforcement of medication safety principles may lead to unsafe shortcuts, omission of verification steps, and reduced willingness to report near-miss events, all of which threaten patient safety and weaken professional development (5).

Educational interventions have increasingly been recognized as an effective strategy to strengthen medication safety competence in nursing trainees and early-career nurses. Structured teaching sessions, simulation-based learning, supervised demonstrations, feedback-oriented training, and case-based exercises have all been shown to improve knowledge retention, safety-related attitudes, and adherence to correct medication practices (6). Experimental and quasi-experimental studies have reported gains in understanding of medication safety principles, improved confidence in medication administration, and better compliance with safe administration procedures following focused educational exposure (7,8). These findings are consistent with adult learning theory and competency-based education, which propose that active engagement, repetition, contextualized instruction, and performance feedback support durable learning and safer clinical behavior (9).

In lower- and middle-income healthcare settings, the need for such interventions may be even greater because interns often train in environments affected by high patient volumes, staff shortages, inconsistent mentorship, and limited access to standardized safety reinforcement. Pakistani studies have reported variable and often suboptimal knowledge regarding medication errors, intravenous medication safety, and error prevention among nurses and nursing trainees, suggesting that gaps persist at the interface of education and practice (10,11). Local evidence further indicates that institutional barriers such as inadequate supervision, fear of blame, and weak safety culture may reduce the translation of knowledge into consistent safe practice, particularly in relation to documentation and error reporting (12). Although prior studies support educational approaches for strengthening medication safety, much of the available literature from Pakistan has been descriptive, cross-sectional, or limited to knowledge assessment alone, with relatively few studies evaluating whether a structured intervention can simultaneously improve knowledge, attitude, and practice among nursing interns in an actual teaching-hospital context (13).

This gap is important because improvement in knowledge alone does not necessarily ensure safer bedside behavior. Educational interventions intended for nursing interns should therefore be evaluated not only for cognitive gain but also for their effect on confidence, professional attitude, and self-reported medication administration practices. A context-specific assessment in a tertiary teaching hospital can provide practical evidence for curriculum enhancement, clinical mentorship planning, and patient safety initiatives relevant to internship training programs. Against this background, the present study was undertaken to evaluate the effectiveness of a structured educational intervention on knowledge, attitude, and practice regarding safe medication administration among nursing interns at Shahida Islam Teaching Hospital, Lodhran. It was hypothesized that nursing interns would demonstrate significantly

improved post-intervention scores in knowledge, attitude, and practice related to safe medication administration compared with their pre-intervention scores (14).

## MATERIALS AND METHODS

A quasi-experimental one-group pre-test and post-test study was conducted at Shahida Islam Teaching Hospital, Lodhran, a tertiary care teaching institution affiliated with Shahida Islam Nursing College, Punjab, Pakistan. The study targeted nursing interns undergoing clinical rotations in the hospital during the data collection period. This design was selected because it allowed direct evaluation of within-participant change in medication safety-related outcomes before and after exposure to a structured educational intervention, thereby providing a practical estimate of short-term effectiveness in a real clinical training environment (15).

The study population comprised nursing interns enrolled in hospital-based internship training. Participants were recruited using convenience sampling from those present during the study period and available for both the intervention and outcome assessment sessions. Eligibility criteria included active enrollment in clinical internship rotations, availability at the time of pre-test, intervention, and post-test administration, and willingness to provide informed consent. Individuals not belonging to the nursing intern category, including certified nursing assistants, lady health visitors, and midwives, were excluded to maintain homogeneity of training background and scope of practice. A total sample of 34 participants was included. The sample size had been estimated from parameters adopted from prior intervention-based literature, using pre- and post-intervention mean values and standard deviations with specified type I and type II error assumptions; the calculated value of 33.9 was rounded up to 34 to ensure complete enrollment of the required minimum number of participants (16).

The educational intervention consisted of a structured 45-minute teaching session focused on safe medication administration. The content was developed around core medication safety principles and included the Five Rights of medication administration, patient identification, dose and route verification, checking medication expiry, timely documentation, and medication error prevention and reporting. Delivery methods included a didactic lecture, PowerPoint-assisted teaching, demonstration of correct medication administration principles, and interactive discussion to reinforce understanding and allow participant engagement. Standardization of intervention delivery was maintained by using the same content sequence, teaching objectives, and instructional materials for all participants. Data collection was organized in three phases. During the pre-test phase, eligible participants completed a structured questionnaire to record demographic characteristics and baseline responses for knowledge, attitude, and practice domains. The intervention was then delivered in a controlled group teaching session. The post-test phase was conducted one week later using the same questionnaire to assess immediate change after the intervention while preserving a brief interval for retention and reflection (17).

The data collection instrument consisted of four sections covering demographic variables, knowledge regarding safe medication administration, attitude toward medication safety, and self-reported practice related to medication administration procedures. The questionnaire was adapted from previously published work assessing nurse interns' medication administration safety performance. Adaptation was undertaken to align item wording with the local clinical training context while preserving the conceptual structure of the original tool. Knowledge items assessed understanding of essential safety principles such as the Five Rights, patient verification, unsafe practice recognition, expiry checking, and appropriate response to medication error. Attitude items examined beliefs regarding the importance of medication safety principles, continuous education, confidence in medication administration, reporting of near-miss errors, and the perceived value of educational interventions. Practice items assessed self-reported adherence to patient identity verification, dose double-checking, correct route and timing, immediate documentation, and prompt reporting of errors or near misses. To improve content appropriateness, the adapted questionnaire was reviewed before implementation for clarity, relevance,

and consistency with study objectives. Data were collected anonymously, and participants were instructed not to discuss responses during questionnaire completion in order to reduce information contamination between assessment points.

The principal outcome variables were post-intervention changes in knowledge, attitude, and practice scores. The independent variable was the structured educational intervention on safe medication administration. Demographic variables included age, gender, educational qualification, and duration of internship. Operationally, higher post-test scores were interpreted as improvement in the respective domain. Because the study used a one-group design, steps were taken to reduce foreseeable sources of bias by applying the same questionnaire in both phases, maintaining uniform intervention delivery, using a fixed one-week interval between assessments, and restricting participation to those present at all stages of data collection. The use of a single-site convenience sample may have introduced selection bias and limited generalizability; however, this approach was appropriate for an initial hospital-based evaluation of intervention effectiveness among accessible nursing interns. To minimize response bias, confidentiality was emphasized and participants were assured that responses would be used solely for academic research and would not affect academic standing or clinical evaluation.

Data were entered, cleaned, and analyzed in the Statistical Package for the Social Sciences. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant characteristics and domain-specific responses. Paired-sample t-tests were applied to compare pre-test and post-test mean scores for individual items and overall domains, with statistical significance set at  $p < 0.05$ . Analysis focused on complete paired observations obtained from participants who completed both assessments. Because the sample was relatively small and the study objective was to assess direct pre-post change rather than model multiple predictors, no multivariable adjustment was performed. Data integrity was supported through consistent coding, verification of entries against questionnaire responses, and analysis of matched pre- and post-intervention observations only (18).

Ethical approval for the study was obtained from the Institutional Review Board of Shahida Islam Nursing College, Lodhran, before commencement of data collection. Administrative permission was also secured from the hospital authorities. Written informed consent was obtained from all participants before enrollment. Participation was entirely voluntary, and participants were informed of their right to withdraw at any stage without penalty. Confidentiality and anonymity were maintained throughout data collection, handling, analysis, and reporting. All study procedures were conducted in accordance with accepted ethical standards for human participant research.

## RESULTS

A total of 34 nursing interns were included in the analysis. Most participants were aged 23–25 years (73.6%,  $n=25$ ), followed by 20–22 years (17.6%,  $n=6$ ) and 26 years or above (8.8%,  $n=3$ ). Female participants constituted 73.5% ( $n=25$ ), whereas 26.5% ( $n=9$ ) were male. All participants were enrolled in BSc Nursing, and more than half had completed over 6 months of internship training (52.9%,  $n=18$ ), while 23.5% ( $n=8$ ) had less than 3 months and 23.5% ( $n=8$ ) had 3–6 months of internship experience. These findings indicate that the study group was predominantly composed of young adult female BSc nursing interns with moderate to substantial clinical exposure.

The educational intervention was associated with improvement across all five knowledge items. The largest absolute gain was observed for knowledge of the Five Rights of medication administration, where the mean score increased from  $0.35 \pm 0.12$  to  $0.79 \pm 0.10$ , representing a mean change of 0.44 and a relative increase of 125.7% ( $p=0.002$ ). Patient identification knowledge improved from  $0.44 \pm 0.15$  to  $0.76 \pm 0.11$ , a gain of 0.32 or 72.7% ( $p=0.013$ ). Checking medication expiry also improved significantly from  $0.50 \pm 0.14$  to  $0.82 \pm 0.09$ , corresponding to a change of 0.32 or 64.0% ( $p=0.004$ ). Although recognition of unsafe medication practices increased from  $0.59 \pm 0.18$  to  $0.77 \pm 0.16$ , the 0.18-point gain was not statistically significant ( $p=0.102$ ). Similarly, the score for appropriate action after a medication error rose from

0.68±0.11 to 0.88±0.07, a 29.4% relative increase, but did not reach statistical significance (p=0.061). Overall, the pattern indicates that the intervention produced the strongest measurable effects in core safety verification steps rather than in error recognition and post-error response.

*Table 1. Demographic Characteristics of Participants (n=34)*

Variable	Category	Frequency	Percentage (%)
Age (years)	20–22	6	17.6
	23–25	25	73.6
	26 and above	3	8.8
Gender	Male	9	26.5
	Female	25	73.5
Educational qualification	BSc Nursing	34	100.0
Duration of internship	<3 months	8	23.5
	3–6 months	8	23.5
	>6 months	18	52.9

*Table 2. Comparison of Pre-Test and Post-Test Knowledge Scores*

Item	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Change	Relative Change (%)	t-value	p-value	Interpretation
<b>B1. Five Rights of medication administration</b>	0.35 ± 0.12	0.79 ± 0.10	0.44	125.7	-3.45	0.002	Significant
<b>B2. Patient identity verification</b>	0.44 ± 0.15	0.76 ± 0.11	0.32	72.7	-2.61	0.013	Significant
<b>B3. Unsafe medication administration practice recognition</b>	0.59 ± 0.18	0.77 ± 0.16	0.18	30.5	-1.68	0.102	Not significant
<b>B4. Checking medication expiry</b>	0.50 ± 0.14	0.82 ± 0.09	0.32	64.0	-3.12	0.004	Significant
<b>B5. Response to medication error</b>	0.68 ± 0.11	0.88 ± 0.07	0.20	29.4	-1.94	0.061	Not significant

Attitude toward safe medication administration improved in four of five domains with statistically significant change. Belief in the protective role of the Five Rights increased from 4.09±0.58 to 4.62±0.49, a mean gain of 0.53 or 13.0% (p=0.007). Perceived value of continuous education rose from 4.00±0.62 to 4.51±0.44, corresponding to a 0.51-point improvement or 12.8% (p=0.021). Confidence in administering medication showed one of the largest attitudinal gains, increasing from 4.12±0.57 to 4.70±0.40, with a mean difference of 0.58 or 14.1% (p=0.002). The perceived benefit of educational interventions on nursing practice improved from 4.03±0.63 to 4.55±0.50, a 12.9% relative increase (p=0.033). In contrast, the attitude toward reporting near-miss errors increased from 3.88±0.68 to 4.32±0.52, but this 0.44-point change was not statistically significant (p=0.110). This pattern suggests that the intervention successfully strengthened safety-oriented beliefs and self-confidence, while more persistent organizational barriers may continue to influence reporting-related attitudes.

*Table 3. Comparison of Pre-Test and Post-Test Attitude Scores*

Item	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Change	Relative Change (%)	t-value	p-value	Interpretation
<b>C1. Following the Five Rights prevents medication errors</b>	4.09 ± 0.58	4.62 ± 0.49	0.53	13.0	-2.83	0.007	Significant
<b>C2. Continuous education improves medication administration skills</b>	4.00 ± 0.62	4.51 ± 0.44	0.51	12.8	-2.41	0.021	Significant
<b>C3. Confidence while administering medications</b>	4.12 ± 0.57	4.70 ± 0.40	0.58	14.1	-3.35	0.002	Significant
<b>C4. Reporting near-miss errors is important for patient safety</b>	3.88 ± 0.68	4.32 ± 0.52	0.44	11.3	-1.64	0.110	Not significant
<b>C5. Educational interventions positively influence nursing practice</b>	4.03 ± 0.63	4.55 ± 0.50	0.52	12.9	-2.21	0.033	Significant

Practice-related outcomes also improved after the intervention, with significant gains in three of five items. Verification of patient identity before medication administration increased from 4.29±0.56 to 4.82±0.39, representing a mean gain of 0.53 or 12.4% (p=0.005). Adherence to correct route and timing improved from 4.09±0.59 to 4.68±0.43, the largest observed practice-domain gain, with a mean change of 0.59 or 14.4% (p=0.010). Immediate documentation after medication administration improved from 4.12±0.54 to 4.73±0.41, a difference of 0.61 or 14.8% (p=0.002). Dose double-checking increased from

4.21±0.61 to 4.62±0.46, but the 0.41-point change was narrowly non-significant (p=0.052). Reporting medication errors or near-misses showed the smallest practical change, rising from 4.18±0.65 to 4.45±0.50, a gain of 0.27 or 6.5%, and remained non-significant (p=0.206). These findings indicate that the intervention most effectively improved observable safety behaviors tied to bedside verification and documentation, whereas reporting behaviors showed less responsiveness.

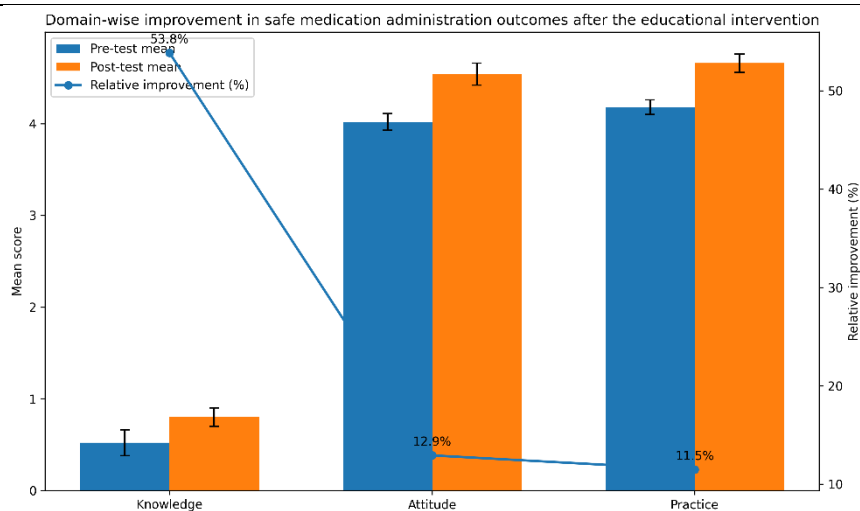
**Table 4. Comparison of Pre-Test and Post-Test Practice Scores**

Item	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Change	Relative Change (%)	t-value	p-value	Interpretation
D1. Verifies patient identity before every medication administration	4.29 ± 0.56	4.82 ± 0.39	0.53	12.4	-3.05	0.005	Significant
D2. Double-checks prescribed dose before giving medication	4.21 ± 0.61	4.62 ± 0.46	0.41	9.7	-2.01	0.052	Not significant
D3. Follows correct route and timing	4.09 ± 0.59	4.68 ± 0.43	0.59	14.4	-2.74	0.010	Significant
D4. Documents medication administration immediately	4.12 ± 0.54	4.73 ± 0.41	0.61	14.8	-3.44	0.002	Significant
D5. Reports medication errors or near-misses promptly	4.18 ± 0.65	4.45 ± 0.50	0.27	6.5	-1.29	0.206	Not significant

At the overall domain level, all three composite outcomes improved after the educational session. Mean knowledge score increased from 0.52±0.14 to 0.80±0.10, an absolute gain of 0.28 and a relative improvement of 53.8%. Mean attitude score rose from 4.02±0.09 to 4.54±0.12, corresponding to a gain of 0.52 or 12.9%. Mean practice score improved from 4.18±0.08 to 4.66±0.10, with an absolute increase of 0.48 and a relative improvement of 11.5%. The largest relative change occurred in knowledge, indicating that the intervention had its greatest impact on cognitive understanding, while attitude and practice also demonstrated consistent positive shifts.

**Table 5. Domain-Wise Comparison of Knowledge, Attitude, and Practice Scores**

Domain	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Change	Relative Change (%)
Knowledge	0.52 ± 0.14	0.80 ± 0.10	0.28	53.8
Attitude	4.02 ± 0.09	4.54 ± 0.12	0.52	12.9
Practice	4.18 ± 0.08	4.66 ± 0.10	0.48	11.5



**Figure 1** The intervention produced improvement across all three domains, but the magnitude of change was clearly greatest for knowledge, which increased from 0.52 to 0.80, corresponding to a 53.8% relative improvement. Attitude improved from 4.02 to 4.54, a 12.9% increase, while practice rose from 4.18 to 4.66, an 11.5% increase. The SD bands remained relatively narrow at both time points for attitude and practice, indicating limited dispersion around already high baseline means, whereas knowledge showed both lower baseline performance and the steepest post-intervention gain, suggesting that the educational session exerted its strongest effect on foundational medication-safety understanding before translating into comparatively smaller, though still favorable, gains in attitudinal and practice-related outcomes.

## DISCUSSION

The present study demonstrated that a structured educational intervention produced measurable improvement in nursing interns' knowledge, attitude, and practice regarding safe medication administration. The most pronounced gains were observed in knowledge-related outcomes, particularly in understanding the Five Rights of medication administration, patient identity verification, and checking medication expiry. These findings support the view that focused educational exposure can rapidly strengthen core medication-safety concepts among nursing trainees, especially in domains where baseline knowledge is incomplete or inconsistently applied. The marked post-intervention increase in knowledge scores is consistent with simulation-based and structured training studies showing that targeted medication-safety instruction can improve conceptual accuracy, reinforce procedural awareness, and reduce vulnerability to preventable administration errors in student and intern populations (3,8,9).

The improvement in attitudinal outcomes further suggests that the intervention influenced not only cognitive understanding but also participants' professional orientation toward medication safety. Interns reported stronger belief in the protective role of the Five Rights, greater appreciation of continuous professional education, and improved confidence while administering medications after the training session. This pattern is important because safe medication practice depends not only on knowing what should be done but also on the learner's confidence, safety mindset, and perceived relevance of best-practice behaviors in daily clinical work. Earlier studies have similarly shown that educational reinforcement can enhance confidence, accountability, and positive safety attitudes among nursing students and early-career practitioners, thereby supporting safer bedside decision-making and more consistent adherence to protocols (5,14,16).

Practice-related improvements were also notable, particularly in patient identification, adherence to correct administration procedures, and timely documentation. These changes suggest that the intervention was successful in translating knowledge into at least short-term self-reported behavioral improvement. From a clinical standpoint, these gains are meaningful because patient verification, correct route and timing, and immediate documentation represent high-frequency safety checkpoints in routine nursing care. Improvement in these areas indicates that even a brief structured session may enhance procedural vigilance in settings where nursing interns are developing practical competence under supervision. Similar findings have been reported in intervention-based nursing education literature, where focused teaching and demonstration improved adherence to medication administration standards and promoted safer clinical execution of routine tasks (8,12,14).

At the same time, not all domains improved to the same extent, and this uneven pattern is analytically important. Although post-test means increased for recognition of unsafe practices, medication error response, dose double-checking, and prompt reporting of errors or near-misses, these changes did not achieve statistical significance. Rather than weakening the overall findings, this pattern helps clarify where educational sessions alone may be insufficient. Reporting-related behaviors and near-miss awareness are often shaped not only by knowledge but also by institutional culture, supervisory style, fear of blame, and hierarchical communication barriers. The lack of statistically significant change in reporting-oriented items therefore suggests that interns may understand the importance of safe practice yet remain hesitant to disclose errors in environments where reporting is not consistently normalized or psychologically safe. This interpretation aligns with prior work identifying blame culture, inadequate support systems, and weak reporting frameworks as major barriers to medication error disclosure among nurses and trainees (13,18).

The larger relative improvement in knowledge compared with attitude and practice also deserves attention. Knowledge increased by more than half at the overall domain level, whereas attitude and practice improved by smaller but still favorable margins. This gradient suggests that educational

interventions may first exert their strongest effect on cognitive learning, with attitudinal and behavioral consolidation occurring more gradually. Such a sequence is plausible within adult learning and competency-based education frameworks, where conceptual mastery often precedes stable behavioral adoption. In practical terms, this means that a single intervention may be highly effective for correcting informational gaps, but sustained improvement in complex practice patterns may require repeated reinforcement, mentorship, supervised clinical feedback, and a broader organizational commitment to patient safety (5,9,13).

The findings of this study have implications for nursing education and hospital training systems in Pakistan and comparable resource-constrained settings. Because nursing interns often enter clinical environments with variable levels of preparedness, structured medication-safety teaching should be incorporated as a recurring component of internship orientation and competency development rather than as a one-time activity. Educational programming that combines lecture, demonstration, case-based learning, and ongoing mentorship may be particularly beneficial in strengthening both technical competence and reporting culture. The present results support the use of structured educational interventions as a practical and scalable strategy for improving medication-safety readiness among interns, especially in tertiary care hospitals where patient turnover, workload, and medication complexity heighten the need for rigorous administration practices (4,6,10).

Several limitations should be considered while interpreting the results. The study used a one-group pre-test and post-test design without a comparison group, so causal inference remains limited and some improvement may reflect testing or short-term recall effects. The sample size was small and drawn from a single teaching hospital using convenience sampling, which limits generalizability. In addition, attitude and practice were assessed through self-reported responses, which may overestimate actual compliance with medication-safety behaviors. The post-test was conducted one week after the intervention, allowing only short-term evaluation of impact and not long-term retention. Nevertheless, the consistency of improvement across most domains suggests that the intervention had practical educational value, while also highlighting areas, especially error reporting and near-miss disclosure, that require broader institutional reinforcement beyond classroom-based teaching alone.

## CONCLUSION

In conclusion, the structured educational intervention was effective in improving nursing interns' knowledge, attitude, and practice regarding safe medication administration at Shahida Islam Teaching Hospital, Lodhran. The strongest gains were observed in knowledge-related outcomes, while meaningful improvements were also seen in confidence, safety-oriented attitudes, patient verification, correct administration procedures, and documentation practices. However, reporting-related behaviors and some safety-response items showed only limited change, indicating that educational training should be complemented by supportive supervision and a non-punitive institutional safety culture. Overall, the findings support the integration of regular, competency-based medication-safety education into nursing internship training to strengthen clinical performance and promote patient safety.

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