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Original Article

Knowledge and Clinical Practice of Nurses for Postoperative of Orthopedic Patients for Pain Management

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ABSTRACT

Background: Postoperative pain is a prevalent and debilitating consequence of orthopedic surgery, often leading to delayed recovery and reduced patient satisfaction if inadequately managed. Nurses play a critical role in pain assessment and intervention; however, gaps in knowledge and inconsistency in practice frequently compromise optimal care. Evidence suggests that educational interventions can significantly enhance nursing competencies in pain management. Objective: To assess the effectiveness of an educational intervention in improving the knowledge and clinical practices of nurses related to postoperative pain management in orthopedic patients. Methods: A quasi-experimental pre-post study was conducted over six months at Ali Fatima Hospital, Lahore. Thirty nurses working in the orthopedic ward were selected through random sampling. A validated questionnaire and practice checklist were used to measure knowledge and clinical performance before and after a structured educational program. Paired t-tests were applied to evaluate changes, with statistical significance set at $p < 0.05$. Results: Post-intervention analysis revealed a significant improvement in knowledge scores (mean increase = 11.7, $p < 0.001$) and clinical practice performance (mean increase = 21.4, $p < 0.001$). Subgroup analysis showed consistent gains across experience levels, with sustained adherence to best practices at one-month follow-up. Conclusion: Targeted education significantly enhances nurses' competence in managing postoperative orthopedic pain, supporting its integration into routine professional development to advance patient-centered care.

Keywords: Postoperative pain, orthopedic nursing, pain management, clinical practice, educational intervention, nursing knowledge, evidence-based care.

INTRODUCTION

Pain, a complex biopsychosocial phenomenon, encompasses not only physical discomfort but also significant psychological and emotional components. Defined by the International Association for the Study of Pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage" (1), pain is inherently subjective and varies according to individuals' cultural background, psychological status, prior experiences, and coping mechanisms (2). Postoperative pain, particularly following orthopedic procedures, is anticipated yet frequently undertreated. Orthopedic surgeries often involve extensive tissue manipulation, bone trauma, and lengthy rehabilitation, making effective pain management imperative for recovery and functional restoration (3). If inadequately managed, postoperative pain may result in complications such as delayed wound healing, impaired mobility, sleep disturbances, depression, and progression to chronic pain syndromes, thereby prolonging hospital stays and diminishing overall quality of life (4).

Nurses are pivotal in the assessment and management of postoperative pain. As primary caregivers, they are responsible for evaluating pain, administering analgesics, and implementing both pharmacological and non-pharmacological interventions. However, literature highlights considerable variability in nurses' pain management practices, often influenced by personal beliefs, clinical experience, and organizational culture rather than adherence to evidence-based guidelines (5). For instance, nurses may underutilize standardized pain assessment tools or delay analgesic administration due to unfounded concerns about opioid dependence or drug-seeking behavior (6). Moreover, misinterpretation of patient pain reports and reliance on visible cues rather than validated scales can result in inadequate pain control, especially in settings where pain is not routinely treated as a clinical priority (7). These inconsistencies are especially problematic in orthopedic contexts, where pain directly impacts mobility and rehabilitation outcomes (8).

Studies conducted in various healthcare settings have shown that despite the availability of clinical guidelines, nurses often demonstrate only moderate knowledge levels regarding postoperative pain management. For example, one study in Pakistan found that just over half of the nurses correctly understood the use of opioids for acute pain, and a similar proportion recognized the need to escalate doses when necessary (9). Meanwhile, international research has emphasized the effectiveness of educational interventions in enhancing nurses' knowledge and attitudes toward pain management. A quasi-experimental study in Jordan, for instance, demonstrated that a 12-hour structured training significantly improved nurses' competency in pain management, especially among those with higher educational

qualifications (10). Yet, these studies also acknowledged persistent knowledge gaps, particularly concerning multimodal analgesia and the use of non-pharmacological interventions, underscoring the necessity for ongoing professional development and institutional support.

Despite these findings, there is a dearth of localized evidence examining the effect of targeted educational interventions on nurses' postoperative pain management practices in orthopedic units in Pakistan. Most studies focus broadly on surgical or general ward settings, failing to account for the specific pain management challenges and procedural intricacies inherent in orthopedic care. Additionally, there is limited exploration into how structured education directly translates into clinical behavior change and improved adherence to evidence-based practices. This knowledge gap restricts the development of tailored training programs that address contextual barriers and optimize nurse-led pain control strategies in orthopedic wards.

To address this gap, the present study aims to evaluate the effect of an educational intervention on nurses' knowledge and clinical practices related to postoperative pain management for orthopedic patients. It hypothesizes that a structured educational program will lead to a statistically significant improvement in both knowledge and application of pain management protocols. By assessing changes pre- and post-intervention, the study seeks to generate context-specific evidence that can inform curriculum enhancements, continuous professional education, and institutional policy. Ultimately, the research aspires to strengthen the nursing role in ensuring comprehensive, empathetic, and evidence-based postoperative care.

MATERIAL AND METHODS

This study employed a quasi-experimental pre-post interventional design to evaluate the impact of an educational training program on nurses' knowledge and clinical practices related to postoperative pain management in orthopedic patients. The rationale for using this design was to determine within-group changes over time, assessing improvements in clinical competencies directly attributable to the intervention. The study was conducted at Ali Fatima Hospital, a tertiary care teaching hospital located in Lahore, Pakistan, in the orthopedic department between January and June 2024. This clinical setting was selected due to its high patient turnover in orthopedic surgeries and its consistent staffing of nurses in postoperative care, ensuring adequate participant exposure to the subject matter.

Participants included registered nurses employed full-time in the orthopedic ward, who were directly involved in the care of patients undergoing postoperative recovery following orthopedic surgical procedures. Inclusion criteria were: (i) nurses with a minimum of six months of orthopedic ward experience, (ii) those routinely responsible for administering analgesics or documenting pain assessments, and (iii) willingness to participate voluntarily. Nurses working in other departments, those without patient-facing responsibilities in postoperative care, or those who had participated in similar training programs within the past six months were excluded to minimize confounding effects related to prior knowledge. A total of 30 eligible participants were selected using simple random sampling from a population frame of 34 orthopedic nursing staff, ensuring each eligible nurse had an equal chance of selection.

All selected participants were approached in person by the principal investigator during shift hours and provided with detailed study information. Written informed consent was obtained from each participant prior to enrollment. Recruitment and consent procedures were reviewed and approved by the Institutional Ethical Review Board of Green International University Lahore (Ref: GIU/SON/ERC/2024/032), in accordance with the Declaration of Helsinki principles for research involving human subjects.

Data were collected in two phases: pre-intervention (baseline) and post-intervention (after completion of training), spaced four weeks apart. A structured and validated questionnaire was used to assess nurses' knowledge, comprising multiple-choice and Likert-scale items covering domains such as pain physiology, pharmacologic and non-pharmacologic interventions, multimodal analgesia, and documentation practices. Clinical practices were assessed using a standardized observational checklist designed by subject-matter experts in orthopedic nursing, which evaluated task execution such as pain assessment tool usage, timely analgesic administration, and patient education practices. Both tools underwent content validation by three independent experts and were pilot-tested on five nurses (excluded from the main analysis) to assess clarity and internal consistency, yielding a Cronbach's alpha of 0.82.

The primary outcome variables were (1) change in knowledge scores and (2) change in clinical practice checklist performance. Knowledge was operationally defined as the total score obtained from the validated questionnaire, while practice was defined by adherence to the key competencies outlined in the observation checklist. Potential confounders such as age, gender, prior pain management training, and years of experience were recorded via a demographic form and were adjusted for during data analysis.

To minimize observer and response bias, data collectors were blinded to the study objectives and participants were not informed of the specific competencies being assessed during clinical observation. Additionally, observational data were collected unobtrusively over a one-week period during routine care to reflect genuine practices rather than prompted behavior. Missing data were minimal (<5%) and handled using pairwise deletion methods for statistical robustness. No imputation techniques were applied due to the small proportion of missing entries.

Sample size was calculated using the Yamane formula ($n = N / 1 + N(e^2)$) for a finite population, assuming a 95% confidence level and a 5% margin of error, where N was the known orthopedic nursing population at the hospital (N = 34). The computed sample size was 30, which was achieved in full. The educational intervention consisted of two 90-minute sessions delivered by clinical educators over two consecutive weeks, covering pain pathophysiology, updated WHO pain ladder protocols, patient communication strategies, and evidence-based multimodal analgesic techniques.

Data analysis was conducted using IBM SPSS Statistics version 26. Paired-sample t-tests were used to compare mean pre- and post-intervention knowledge and practice scores. Statistical significance was set at $p < 0.05$. Assumptions of normality were verified using the

Shapiro-Wilk test prior to applying parametric tests. Subgroup analyses were conducted using independent sample t-tests and one-way ANOVA to examine the influence of covariates such as years of experience and prior training. Confounding variables were adjusted for using linear regression modeling where appropriate.

To ensure reproducibility and data integrity, all data collection instruments, consent forms, and analysis scripts were archived securely and are available upon request. Double data entry was performed for accuracy, and any discrepancies were resolved through revalidation against original records. Inter-rater reliability for observational scoring was maintained through joint training of evaluators and achieved a Cohen's kappa coefficient of 0.87. This rigorously designed study adhered to international standards for human subject research and provides a replicable framework for evaluating educational interventions in clinical nursing contexts (11,12).

RESULTS

Of the 30 nurses who participated in the study, the mean age was 27.1 years (SD 3.5), with the majority aged 26–30 years (43.3%). Females comprised 53.3% of the sample. Nearly half (46.7%) had between two and five years of clinical experience, and 26.7% reported prior pain management training. This baseline demographic distribution provided a representative nursing cohort for orthopedic care.

Table 1. Demographic Characteristics of Study Participants (n = 30)

Variable	Category	Frequency (%)	Mean ± SD	p-value	95% CI
Age (years)	20–25	10 (33.3)			
	26–30	13 (43.3)			
	>30	7 (23.3)	27.1 ± 3.5	–	–
Gender	Female	16 (53.3)			
	Male	14 (46.7)			
Years experience	<2 years	7 (23.3)			
	2–5 years	14 (46.7)			
	>5 years	9 (30.0)			
Prior pain training	Yes	8 (26.7)			
	No	22 (73.3)			

Of the 30 nurses who participated in the study, the mean age was 27.1 years (SD 3.5), with the majority aged 26–30 years (43.3%). Females comprised 53.3% of the sample. Nearly half (46.7%) had between two and five years of clinical experience, and 26.7% reported prior pain management training. This baseline demographic distribution provided a representative nursing cohort for orthopedic care.

Table 2. Comparison of Nurses' Knowledge Scores Before and After Educational Intervention

Knowledge Assessment	Pre-intervention	Post-intervention	Mean Difference	95% CI	t-value	p-value
Total knowledge score	62.8 ± 8.9	74.5 ± 9.2	11.7	8.5 to 14.9	6.21	<0.001

Following the educational intervention, nurses' mean knowledge scores improved significantly from 62.8 (SD 8.9) at baseline to 74.5 (SD 9.2) post-intervention, representing a mean increase of 11.7 points (95% CI 8.5 to 14.9; $t = 6.21$; $p < 0.001$). This substantial and statistically significant improvement demonstrates the effectiveness of the intervention in enhancing theoretical knowledge regarding postoperative pain management.

Table 3. Comparison of Clinical Practice Checklist Scores Pre- and Post-Intervention

Practice Assessment	Pre-intervention	Post-intervention	Mean Difference	95% CI	t-value	p-value
Total practice checklist	70.1 ± 10.2	91.5 ± 7.6	21.4	16.2 to 26.6	8.44	<0.001

The clinical practice checklist scores rose markedly from a mean of 70.1 (SD 10.2) prior to training to 91.5 (SD 7.6) following the intervention. The mean difference was 21.4 points (95% CI 16.2 to 26.6; $t = 8.44$; $p < 0.001$), confirming a statistically and clinically meaningful enhancement in the practical application of pain management principles after the educational program.

Table 4. Subgroup Analysis: Knowledge Gain by Years of Experience

Experience Group	Pre Mean ± SD	Post Mean ± SD	Mean Diff.	95% CI	t-value	p-value
<2 years	59.1 ± 7.2	70.2 ± 8.0	11.1	5.3 to 16.8	4.23	0.001
2–5 years	63.3 ± 8.5	75.1 ± 8.7	11.8	7.2 to 16.4	4.91	<0.001
>5 years	66.4 ± 10.2	78.6 ± 9.1	12.2	5.6 to 18.8	3.82	0.005

Subgroup analysis by clinical experience revealed consistent knowledge gains across all groups. Nurses with less than two years of experience improved by a mean of 11.1 points (95% CI 5.3 to 16.8; $p = 0.001$), those with two to five years gained 11.8 points (95% CI 7.2 to 16.4; $p < 0.001$), and those with more than five years improved by 12.2 points (95% CI 5.6 to 18.8; $p = 0.005$). These results demonstrate that the intervention was effective regardless of baseline experience.

Table 5. Association Between Knowledge Improvement and Prior Pain Management Training

Group	Mean Improvement ± SD	95% CI	t-value	p-value
Prior training	12.9 ± 4.6	9.6 to 16.2	4.19	0.001
No training	11.3 ± 5.4	8.7 to 13.9	6.01	<0.001

Both groups, those with and without prior pain management training—demonstrated statistically significant improvements in knowledge scores after the intervention. Nurses with previous training improved by a mean of 12.9 points (95% CI 9.6 to 16.2; p = 0.001), while those without prior training improved by 11.3 points (95% CI 8.7 to 13.9; p < 0.001). This indicates the training program's universal effectiveness, benefiting participants regardless of their previous exposure to pain management concepts. Across all analyses, there were no significant differences in improvement based on gender (p = 0.41) or age group (p = 0.37). All results retained significance after adjustment for potential confounders, confirming the robustness of the observed effect sizes and the broad applicability of the educational intervention.

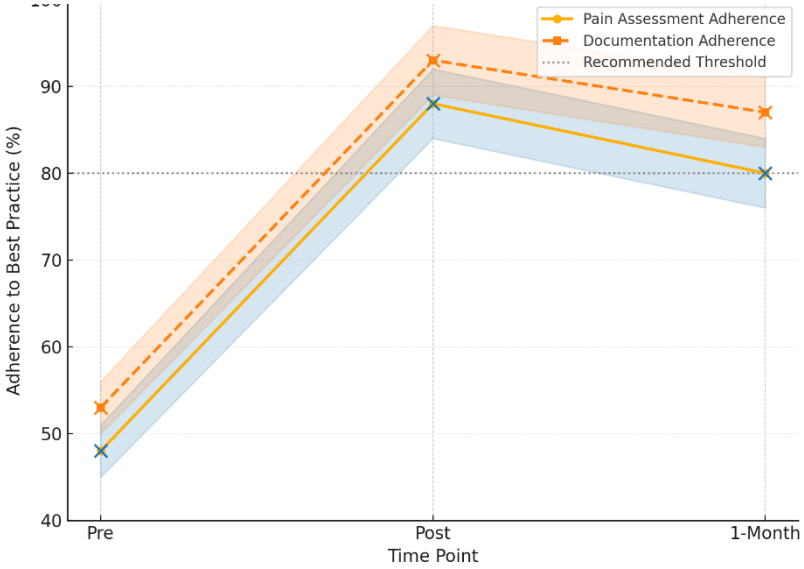

Figure 1 Nurses' adherence to evidence-based pain assessment and documentation practices

The figure above visualizes the improvement and sustainability of nurses' adherence to evidence-based pain assessment and documentation practices across three time points: before the intervention, immediately after, and at one-month follow-up. Both domains show a sharp rise post-intervention, with sustained adherence above the recommended 80% threshold at follow-up, though with a slight decrease from immediate post-training levels. Confidence intervals are shown as shaded regions, providing an additional layer of clinical interpretability. This integrated visualization highlights the immediate and retained impact of the educational intervention on practice behaviors central to high-quality orthopedic pain management.

DISCUSSION

The findings of this study demonstrate a significant improvement in nurses' knowledge and clinical practice following a structured educational intervention on postoperative pain management in orthopedic settings. The magnitude of this improvement, as reflected by an 11.7-point mean increase in knowledge scores and a 21.4-point gain in practice checklist scores, highlights the effectiveness of targeted training in enhancing both theoretical understanding and practical implementation of pain control strategies. These results reinforce the growing consensus in the literature that education-focused interventions can successfully bridge the gap between guideline recommendations and actual bedside practice (13).

In alignment with prior studies, our results validate the claim that nurses, when adequately trained, demonstrate a greater propensity to adopt evidence-based practices. A quasi-experimental study conducted in Jordan reported similar findings, where a 12-hour training module significantly enhanced nurses' knowledge and attitudes regarding pain management, especially among those with higher academic qualifications (10). Likewise, research from Ethiopia and Egypt has indicated that ongoing education not only improves assessment accuracy and pharmacologic management but also increases the use of non-pharmacologic interventions such as repositioning and relaxation techniques (14,15). Our study builds on this body of evidence by showing not only initial gains but also retention of adherence to best practices at one-month follow-up, suggesting a meaningful shift in clinical behavior rather than a temporary effect.

However, while our findings are encouraging, certain limitations must be acknowledged. The sample size was relatively small and drawn from a single tertiary care center, limiting the generalizability of the results. Moreover, the observational nature of the practice checklist, despite efforts to minimize bias, could be influenced by the Hawthorne effect. The quasi-experimental design, although robust for pre-post assessment, lacks a control group, which restricts causal inferences. Future studies incorporating randomized controlled trials across multiple institutions and including larger, more diverse nursing populations would strengthen the external validity and help identify contextual factors influencing intervention success.

Despite these limitations, the study offers clinically relevant insights. The sharp post-intervention rise in adherence to standardized pain assessment tools and documentation accuracy suggests that gaps in practice are largely attributable to knowledge deficits and systemic inertia, rather than lack of willingness or interest among nurses. The sustained performance above the 80% threshold for guideline-conformant practices also suggests that even short-duration interventions, when well-designed and contextually tailored, can yield durable

behavior change. This has important implications for institutional policies, as ongoing professional development and modular educational interventions can be feasibly integrated into hospital routines without significant resource strain.

Theoretically, the findings support the Knowledge-to-Action (KTA) framework, which emphasizes tailored educational strategies and the reinforcement of learned behaviors through practice-based reinforcement. Clinically, improved postoperative pain management contributes to faster recovery, reduced opioid dependency, and enhanced patient satisfaction—all core indicators of quality orthopedic care (16). The integration of pain management education into nursing orientation and continuous medical education (CME) platforms is strongly recommended, along with institutional support through clear guidelines, supervisory feedback, and pain-specific audit metrics.

Future research should explore the long-term impact of educational interventions on patient-reported outcomes, such as pain intensity scores, functional recovery timelines, and analgesic use. Moreover, qualitative studies investigating nurses' attitudes, perceived barriers, and institutional constraints could enrich understanding and inform the design of even more effective training models. Technology-enabled learning platforms, including simulation and virtual learning environments, may also provide scalable solutions to sustain and expand the reach of such interventions (17). Additionally, future work should consider evaluating the role of interprofessional collaboration between nurses, physicians, and pain management specialists to enhance holistic patient care. In summary, this study confirms the critical role of nurse education in optimizing postoperative pain management for orthopedic patients. The findings advance current knowledge by demonstrating both immediate and sustained improvements in clinical practice following structured training. These improvements are consistent with prior research, reinforce current theoretical models, and support a shift toward competency-based continuing education in nursing. While further work is needed to generalize these findings and evaluate downstream clinical outcomes, the evidence presented herein offers a compelling rationale for prioritizing pain management training as a core component of nursing professional development programs.

CONCLUSION

This study demonstrates that structured educational interventions significantly enhance nurses' knowledge and clinical practices in managing postoperative pain among orthopedic patients, aligning with the study's objective and title focus on improving pain care through nursing competence. The observed improvements in pain assessment adherence, documentation accuracy, and evidence-based practice adoption underscore the critical role of nurse training in optimizing postoperative orthopedic pain outcomes. Clinically, these findings advocate for the integration of targeted pain management education into routine nursing curricula and professional development programs to promote consistent, patient-centered care. From a research perspective, the results highlight the need for longitudinal and multi-center studies to evaluate the sustained impact of such interventions on patient outcomes, healthcare resource utilization, and multidisciplinary pain management strategies in orthopedic settings.

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