

Performance of Nurses Regarding postoperative pain management at Dongola Specialized Hospital 2025

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Abstract:

Background: Postoperative pain is a common clinical problem that can delay recovery, increase healthcare costs, and reduce patient satisfaction if not properly managed. Nurses play a crucial role in postoperative pain assessment and management; however, insufficient knowledge and inadequate training remain major barriers to effective pain control.

Objective: To assess nurses' knowledge regarding postoperative pain management, identify factors influencing pain outcomes, and determine barriers affecting effective pain management at Dongola Specialized Hospital, Sudan.

Methodology: A descriptive cross-sectional study was conducted among 50 nurses working in surgical, intensive care, and pediatric departments. Data were collected using a structured self-administered questionnaire and analyzed using SPSS version 26. Descriptive statistics and inferential tests, including Chi-square and Mann-Whitney U tests, were applied, with a significance level of $p < 0.05$.

Results: The overall mean knowledge score was 6.26 ± 1.26 out of 8 (78.2%), indicating a generally good level of knowledge. Most participants (92%) demonstrated moderate to high knowledge levels, while 8% showed low knowledge. The overall general knowledge level among nurses was satisfactory, reflecting an acceptable awareness of postoperative pain management principles. However, 90% of nurses had not received formal training in pain management. The strongest knowledge areas were related to surgical and psychological factors, while the weakest were pharmacological management domains. No statistically significant associations were found between knowledge levels and demographic variables ($p > 0.05$).

Conclusion: Nurses at Dongola Specialized Hospital showed a good overall knowledge (mean = 78.2%), with 92% demonstrating moderate to high awareness and only 8% low knowledge. However, 90% had no formal training and pharmacological knowledge (58–66%) remained weakest.

Recommendations: Regular in-service training and workshops should be conducted to improve nurses' competence in pain management. Standardized hospital protocols should be developed, and continuous education programs should be integrated into nursing curriculum.

Keywords: Nurses Performance, postoperative, pain management, Dongola, specialized hospital

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Introduction:

Background:

Pain is defined as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.” It is a subjective phenomenon influenced by biological, psychological, and social factors. Medical advancements and evidence-based practices have significantly contributed to a better understanding of the multifaceted nature of pain management. Pain remains a common symptom in a wide range of health conditions, including various pathological disorders and traumatic injuries. The literature is replete with evidence highlighting the frequent occurrence of pain following surgical procedures. Unfortunately, as with many other clinical challenges, inadequate knowledge continues to be a major barrier to achieving effective pain management. Post-surgical or postoperative pain is defined as a complex physiological and psychological response to tissue trauma during surgery, which activates the central nervous system and leads to pain perception. (1). alarmingly, ineffective pain management remains a widespread issue across the globe, often resulting in prolonged hospital stays and delayed recovery among patients. (2) Postoperative pain, while predictable and concerning, is a manageable clinical condition. However, inadequate assessment, poor physiological monitoring, and insufficient treatment of acute pain can delay patient mobilization, elevate stress levels, and negatively affect overall recovery outcomes. (3). Among the most critical factors influencing effective pain management is the role of nurses. Given their central and indispensable position in patient care, nurses must possess comprehensive and evidence-based knowledge of pain assessment and management. (4) Nevertheless, literature suggests that approximately 50% of healthcare professionals lack sufficient knowledge in this area, which hinders optimal patient outcomes. (5) Pain assessment constitutes a cornerstone of effective pain management. For this reason, many healthcare organizations emphasize frequent and systematic pain assessment. Moreover, numerous experts advocate for pain to be recognized as the “fifth vital sign.” (6). Postoperative pain is both common and consequential—it can delay recovery, increase healthcare costs, and contribute to the development of chronic pain. Nurses play a pivotal role in assessing and managing postoperative pain; however, limited knowledge and inadequate training often compromise the quality of care delivered. (7). In many African settings, up to 95% of patients experience postoperative pain. Contributing barriers include inadequate assessment, limited staff knowledge, patient misconceptions, and resource constraints. These factors collectively exacerbate patient suffering, delay recovery, and reduce the overall quality of care. (8) Pain represents one of the most complex and multidimensional phenomena in human experience, requiring precise conceptual and operational definition for effective clinical management (9) In the postoperative context, surgical tissue injury triggers inflammatory responses that sensitize nociceptors and alter transmission pathways, potentially leading to heightened pain sensitivity and chronic pain if inadequately managed (10).

General objective:

-To study nurses' knowledge regarding Post-operative Pain management.

Specific objectives:

-To assess nurses' knowledge regarding post-operative pain management.

- To identify the main factors that affecting post-operative pain.
- To determine main barriers that affect post-operative pain management.
- To determine the association between dependent variable and independent variable.

Materials and method:

A descriptive cross-sectional hospital-based design was conducted at Dongola Specialized Hospital in Dongola State, Sudan. The study population consisted of all nurses working in Dongola Specialized Hospital during the year 2025. Because the research focused on postoperative pain management, only nurses who were directly involved in surgical care and postoperative patient management were included. This also covered ICU nurses and pediatric postoperative care nurses. The study applied a simple random sampling (total coverage) technique so that the sample would represent the entire study population. The total number of participants (N= 50). The data was collected by structured self-administered questionnaire. Data were entered, cleaned, and analyzed using the Statistical Package for Social Sciences (SPSS, version 26). Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the demographic characteristics and knowledge scores of the participants. Knowledge scores were computed and categorized into excellent, good, and poor based on the predefined rating scale, with results displayed in tables, bar charts, and pie charts. To assess the association between nurses' knowledge levels (dependent variable) and selected demographic/professional factors (independent variables such as age, sex, education, and years of experience), the Chi-square test was applied for categorical data. In addition, independent-samples t-tests and one-way ANOVA were used where appropriate to compare mean knowledge scores across groups. Statistical significance was set at $p < 0.05$. Ethical approval was obtained from the Ethical Committee of the College of Engineering and Medical Sciences before starting the research. Permission to conduct the study was also granted by the administration of Dongola Specialized Hospital. Participation in the study was voluntary, and informed consent was obtained from all respondents.

Results:

The results presented in this chapter are based on responses from 50 nurses working in various Dongola Specialized Hospital. The data analysis encompassed descriptive statistics for demographic variables and knowledge assessment questions, as well as inferential statistical tests to examine associations between variables. All participants completed the questionnaire in its entirety, resulting in 100% response rate with no missing data. The knowledge assessment component consisted of 22 questions, including 14 multiple-choice questions addressing various aspects of postoperative pain management and 8 true/false questions testing specific knowledge points.

Demographic Characteristics of Participants

The demographic profile of the study participants is presented in Figures 4.1–4.6. The sample was relatively homogeneous in several key characteristics. All participants (N = 50, 100%) were aged between 20–30 years, reflecting a relatively young nursing workforce (Figure 4.1).

Regarding gender, the sample was predominantly female, with 49 participants (98.0%) identified as female and only 1 participant (2.0%) as male, consistent with the gender distribution commonly observed in the nursing profession (Figure 4.2).

In terms of educational qualifications, the majority of participants held a bachelor's degree in nursing (n = 41, 82.0%), while 9 participants (18.0%) possessed diploma-level qualifications (Figure 4.3). This indicates a well-educated workforce, with most participants having attained higher education in their field.

The participants' nursing experience demonstrated complete uniformity in two aspects. All participants reported having 5–10 years of overall nursing experience (N = 50, 100%) and 1–5 years of experience in their current department (N = 50, 100%) (Figures 4.4 and 4.5). This consistency provides a relatively controlled sample for assessing knowledge levels.

A notable finding was observed regarding specialized training in pain management. The vast majority of participants (n = 45, 90.0%) had not received any formal pain management training, whereas only 5 participants (10.0%) reported having undergone such training (Figure 4.6). This highlights a significant gap in specialized education that may influence the quality of postoperative pain management delivered to patients.

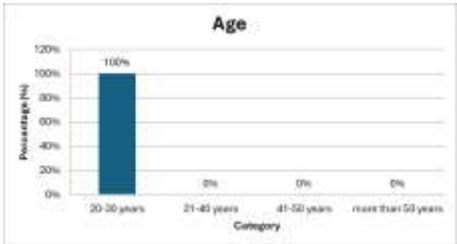


Figure (4.1) Frequency Distributions according to Age (N= 50)

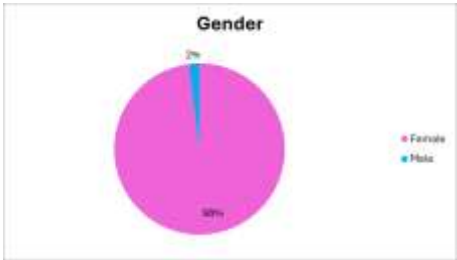


Figure (4.2) Frequency Distributions according to Gender (N= 50)

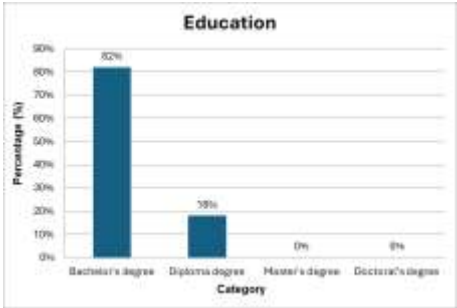


Figure (4.3) Frequency Distributions according to educational qualifications (N = 50)

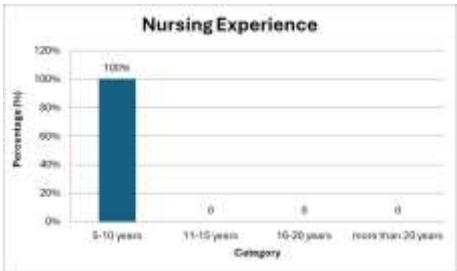


Figure (4.4) Frequency Distributions according to Nursing Experience (N = 50)

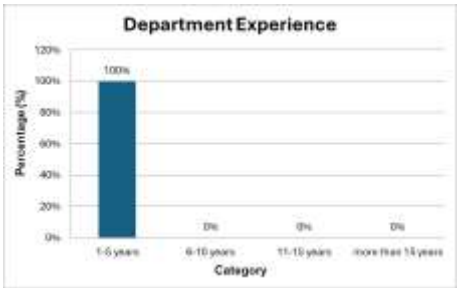


Figure (4.5) Frequency Distributions according to Department Experience (N = 50)



Figure (4.6) Frequency Distributions according to Pain Management Training (N = 50)

NURSES' KNOWLEDGE REGARDING POSTOPERATIVE PAIN MANAGEMENT

Overall Knowledge Assessment

This section evaluates the nurses' overall knowledge of postoperative pain management based on their responses to eight (8) true/false questions. These questions covered fundamental concepts such as pain assessment principles, pharmacological and non-pharmacological interventions, and the importance of regular pain evaluation.

Each correct response was awarded one point, with a maximum possible score of eight. The obtained scores ranged between 3 and 8, indicating variation in the participants' level of knowledge.

The results show that the mean knowledge score was 6.26 (SD = 1.26), which corresponds to 78.2% of the total possible score. This indicates that, on average, the nurses demonstrated a moderately good understanding of postoperative pain management principles. The median score was 6, suggesting that half of the

participants scored six or more correct answers, while the **most frequent score (mode)** was also six.

As presented in **Table (4.2)**, the largest proportion of participants (32.0%) scored six, followed by 22.0% who scored seven, and 20.0% who achieved the full score of eight. Only a small minority (8.0%) scored four or below. This pattern suggests that most nurses had an acceptable but not optimal level of knowledge. A summary of descriptive statistics is provided in **Table (4.3)**.

Table (4.1): Distribution of Nurses' Knowledge Scores (N = 50)

Score (out of 8)	Frequency (n)	Percentage (%)	Cumulative Percentage (%)
3	1	2.0	2.0
4	3	6.0	8.0
5	9	18.0	26.0
6	16	32.0	58.0
7	11	22.0	80.0
8	10	20.0	100.0
Total	50	100.0	—

Table (4.2): Descriptive Statistics of Knowledge Scores (N = 50)

Statistic	Score (out of 8)	Equivalent Percentage (%)	Interpretation
Mean	6.26	78.2	Moderate to good knowledge
Median	6.00	75.0	Half scored ≥ 6
Mode	6.00	75.0	Most frequent score
SD	1.26	—	Moderate variability
Minimum	3.00	37.5	Lowest performance
Maximum	8.00	100.0	Perfect score
Range	5.00	62.5	Moderate spread

Overall, the findings reveal that most nurses demonstrated **adequate knowledge** of postoperative pain management, but there remains **room for improvement**. While a substantial number of participants scored six or above, a notable proportion still achieved lower scores, reflecting **inconsistent understanding** of essential pain management practices.

This suggests the need for **targeted continuing education** and **periodic training** to enhance nurses' competence in evidence-based pain management approaches.

Knowledge Level Categories

Based on percentage scores, participants were categorized into three knowledge levels. The moderate knowledge category (60-79% correct, corresponding to 5-6 points) was the most prevalent, encompassing 25 participants (50.0%). The high knowledge category ($\geq 80\%$ correct, corresponding to 7-8 points) included 21 participants (42.0%), while the low knowledge category ($< 60\%$ correct, corresponding to 3-4 points) comprised only 4 participants (8.0%).

These findings indicate that the majority of participants (92.0%) demonstrated at least moderate knowledge levels, with only a small minority showing low knowledge. However, it is noteworthy that half of the participants did not achieve the high knowledge threshold, suggesting room for improvement in postoperative pain management education. The categorization of knowledge levels is presented in Figure (4.7).

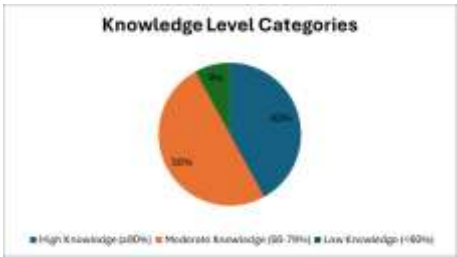


Figure (4.7) Knowledge Level Categories Among Nurses (N=50)

Performance on Specific Knowledge Items

The analysis of individual true/false questions revealed varying levels of performance across different knowledge domains. The highest performance was observed for Question 21, addressing the relationship between surgery type and tissue damage on pain severity, with all participants (100%) answering correctly. This universal correct response suggests strong foundational understanding of the basic physiological principles underlying postoperative pain.

Strong performance was also demonstrated for Question 23, concerning the impact of anesthesia technique selection on pain and analgesic requirements, with 46 participants (92.0%) answering correctly. Similarly, Question 28, addressing the relationship between preoperative anxiety and postoperative pain intensity, was correctly answered by 43 participants (86.0%).

Moderate performance levels were observed for several questions. Question 24, regarding the influence of staffing, monitoring resources, and protocols on pain outcomes, was correctly answered by 41 participants (82.0%). Question 27, addressing how chronic preoperative pain and opioid use worsen acute postoperative outcomes, achieved 74.0% correct responses (n=37). Question 22, concerning the association between smoking history and higher acute postoperative pain, was correctly answered by 34 participants (68.0%).

The areas of weakest performance were identified in Questions 25 and 26, both addressing pharmacological recommendations. Question 25, regarding the recommendation for oral paracetamol and ibuprofen in the perioperative period, achieved 66.0% correct responses (n=33). The lowest performance was observed for Question 26, concerning the reservation of intravenous paracetamol for patients unable to take oral medications, with only 29 participants (58.0%) answering correctly. The detailed performance on each knowledge question is presented in Figures (4.8- 4.15).

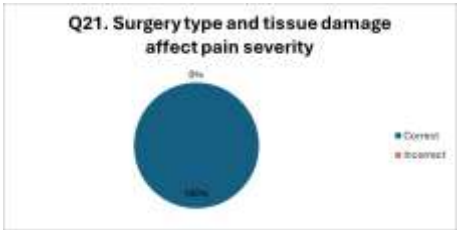


Figure (4.8) Type of surgery and extent of tissue injury influence pain severity (e.g., abdominal, orthopedic, thoracic) (N=50)

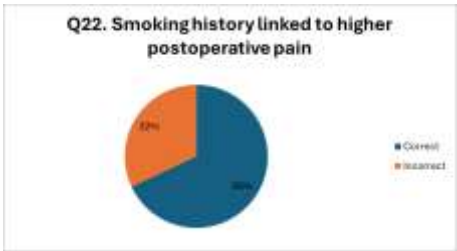


Figure (4.9) Smoking history is linked with higher acute postoperative pain (N=50).

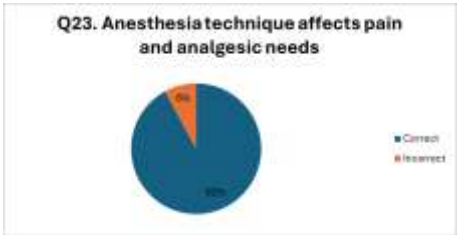


Figure (4.10) Choice of anesthetic technique (general vs. regional) can affect pain and analgesic needs (N=50).

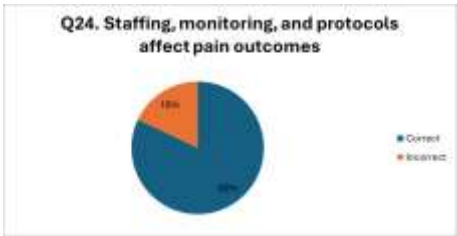


Figure (4.11) Staffing, monitoring resources, and protocols influence pain outcomes (N=50).

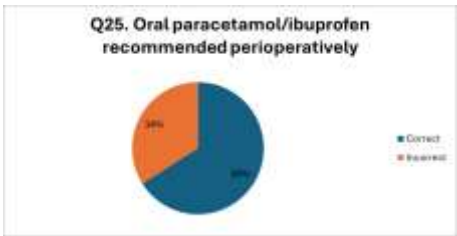


Figure (4.12) Oral paracetamol and ibuprofen (unless contraindicated) are recommended perioperatively (N=50).

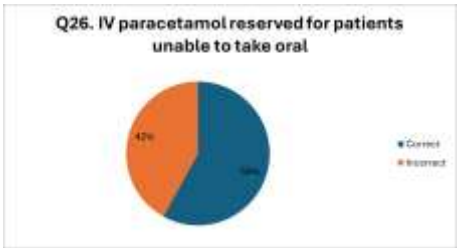


Figure (4.13) IV paracetamol is reserved for patients unable to take oral medication (N=50).

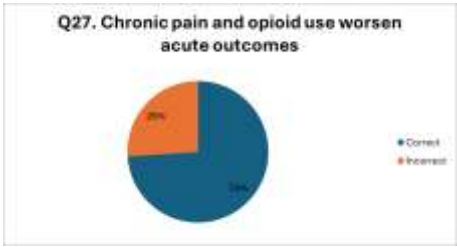


Figure (4.14) Preoperative chronic pain and opioid use worsen acute postoperative outcomes (N=50).

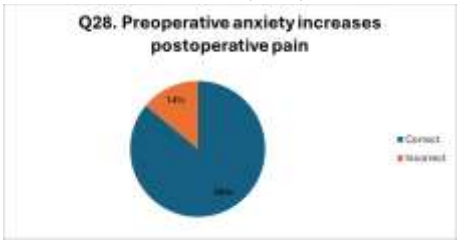


Figure (4.15) Preoperative anxiety increases immediate postoperative pain and analgesic use (N=50).

Analysis of Multiple-Choice Knowledge Questions

A total of fourteen multiple-choice questions (Q7–Q20) were designed to evaluate participants’ knowledge regarding different aspects of postoperative pain management, including definitions, risk factors, management strategies, complications, and assessment criteria.

The findings revealed a broad variation in understanding across these domains. For **pain definition (Q7)**, 34.0% of participants identified pain as “an uncomfortable or unpleasant sensation that can be acute or chronic, physical or emotional.” This variation in selected options indicates differing conceptual interpretations of pain.

Concerning **risk factors for acute postoperative pain (Q8)**, the most frequent response (38.0%) identified “type and nature of invasive surgery” as the main factor increasing acute pain risk. For **comprehensive risk factors in pain management (Q9)**, the most selected responses were “patient-related factors” (30.0%) and “surgical factors” (24.0%).

In **medical management approaches (Q12)**, 40.0% of participants identified “opioid analgesics” as the primary medical intervention, while 32.0% selected “non-opioid

analgesics.” For **nursing management (Q13)**, responses were distributed among “pain assessment” (24.0%), “timely administration of analgesics” (26.0%), and “comprehensive nursing care” (24.0%).

A detailed summary of the most frequently selected responses is presented in **Table 4.3** below.

Table 4.3. Summary of Multiple-Choice Knowledge Questions (Q7–Q20, N = 50)

Question No.	Knowledge Area	Most Selected Answer	Frequency (n)	Percentage (%)
Q7	Pain definition	Pain is an uncomfortable or unpleasant sensation that can be acute or chronic.	17	34.0
Q8	Risk factors for acute postoperative pain	Type and nature of invasive surgery.	19	38.0
Q9	Risk factors for pain management	Patient-related factors.	15	30.0
Q10	Perioperative risk factors	Surgical complexity and duration.	15	30.0
Q11	Factors influencing analgesic selection	Patient condition and type of surgery.	16	32.0
Q12	Medical management approaches	Opioid analgesics.	20	40.0
Q13	Nursing management approaches	Timely administration of analgesics.	13	26.0
Q14	Major complications of pain management	Respiratory depression and nausea/vomiting.	19	38.0
Q15	Patient protection strategies	Continuous monitoring and reassessment of pain.	20	40.0
Q16	Opioid use guidelines	Use opioids according to physician prescription and patient condition.	15	30.0
Q17	Best practices in analgesia	Use multimodal analgesia.	24	48.0
Q18	Nutritional measures in pain management	Provide balanced diet and adequate hydration.	17	34.0
Q19	Medication-related measures	Administer analgesics at prescribed intervals.	24	48.0
Q20	Pain assessment criteria	Assess pain using standardized pain scales.	17	34.0

Note. Each multiple-choice question allowed a single or multiple selection. “Most Selected Answer” indicates the response option most frequently chosen by participants.

Factors Affecting Postoperative Pain

The assessment of nurses' knowledge regarding factors affecting postoperative pain revealed comprehensive understanding across multiple domains. Participants demonstrated recognition of patient-related factors, surgical factors, and system-related factors that influence postoperative pain outcomes.

Patient-related factors were well recognized, with participants identifying age, gender, history of chronic pain, anxiety or depression, pain tolerance, and substance use as significant contributors. The universal correct response (100%) to the question about surgery type and tissue damage impact indicates strong understanding of procedural factors.

Surgical and procedural factors were also well understood, with high performance on questions addressing anesthesia technique selection (92.0% correct) and recognition of invasive surgical procedures as primary risk factors. The moderate

performance on questions addressing perioperative management protocols suggests areas where additional education may be beneficial.

Psychological and behavioral factors received varying recognition levels. The strong performance on preoperative anxiety questions (86.0% correct) demonstrates good understanding of psychological contributors to pain. However, the moderate performance on smoking-related questions (68.0% correct) suggests this risk factor may require additional emphasis in educational programs.

Barriers Affecting Pain Management

While the survey did not include specific questions addressing barriers to postoperative pain management, the knowledge assessment results reveal several areas that may represent barriers to effective practice. The lower performance on pharmacological management questions (58-66% correct responses) suggests knowledge gaps that could impede optimal medication administration practices.

The finding that 90% of participants lacked formal pain management training represents a significant systemic barrier to effective postoperative pain management. This educational gap may contribute to variations in practice quality and consistency of care provided to patients.

The varied responses to multiple-choice questions addressing management approaches suggest inconsistency in understanding of best practices, which could lead to suboptimal pain management decisions in clinical practice.

ASSOCIATION BETWEEN DEPENDENT AND INDEPENDENT VARIABLES

Education Level and Knowledge Performance

The analysis of the relationship between education level and knowledge performance revealed no statistically significant association. Participants with bachelor's degrees achieved a mean knowledge score of 6.44 (SD = 1.14), while those with diploma qualifications achieved a mean score of 5.44 (SD = 1.51). The Mann-Whitney U test yielded a test statistic of $U = 259.500$ with $p = 0.053$, which approached but did not reach statistical significance at the $\alpha = 0.05$ level.

The chi-square analysis examining the association between education level and knowledge level categories showed no significant relationship ($\chi^2 = 3.865$, $df = 2$, $p = 0.145$). Among bachelor's degree holders, 19 (46.3%) demonstrated high knowledge, 20 (48.8%) showed moderate knowledge, and 2 (4.9%) exhibited low knowledge. Among diploma holders, 2 (22.2%) showed high knowledge, 5 (55.6%) demonstrated moderate knowledge, and 2 (22.2%) exhibited low knowledge. The cross-tabulation is presented in Table (4.8).

Pain Management Training and Knowledge Performance

The relationship between formal pain management training and knowledge performance showed no statistically significant association, despite a trend toward higher scores among trained participants. Those who received pain management training achieved a mean knowledge score of 7.00 (SD = 1.00), compared to 6.18 (SD = 1.27) for those without training. The Mann-Whitney U test produced $U = 154.000$ with $p = 0.172$, indicating no significant difference.

The chi-square analysis of training status and knowledge level categories revealed no significant association ($\chi^2 = 0.984$, $df = 2$, $p = 0.611$). Among the 5 participants

with training, 3 (60.0%) demonstrated high knowledge and 2 (40.0%) showed moderate knowledge, with none exhibiting low knowledge. Among the 45 participants without training, 18 (40.0%) showed high knowledge, 23 (51.1%) demonstrated moderate knowledge, and 4 (8.9%) exhibited low knowledge. The cross-tabulation is presented in Table (4.6).

Gender and Knowledge Performance

Given the highly skewed gender distribution (98% female, 2% male), meaningful statistical analysis of gender differences was not feasible. The single male participant achieved the maximum knowledge score of 8 points, while female participants achieved a mean score of 6.22 (SD = 1.25). The Mann-Whitney U test yielded $U = 4.500$ with $p = 0.164$, but this result should be interpreted with extreme caution due to the sample size limitation. The statistical test results are summarized in Table (4.4).

Table (4.4) Statistical Test Results for Associations Between Variables

Analysis	Test	Statistic	df	P-value	Result
Education Level vs Knowledge Level	Chi-square	$\chi^2 = 3.865$	2	0.145	NS
Pain Management Training vs Knowledge Level	Chi-square	$\chi^2 = 0.984$	2	0.611	NS
Pain Management Training vs Knowledge Score	Mann-Whitney U	$U = 154.000$	—	0.172	NS
Education Level vs Knowledge Score	Mann-Whitney U	$U = 259.500$	—	0.053	NS

Note. NS = Not Significant ($p > .05$); df = degrees of freedom; $\alpha = .05$.

Table (4.5) Cross-tabulation of Education Level and Knowledge Level (N=50)

Education Level	High Knowledge	Moderate Knowledge	Low Knowledge	Total
Diploma	2	5	2	9
Bachelor's Degree	19	20	2	41
Total	21	25	4	50

Note. $\chi^2 = 3.865$, $df = 2$, $p = .145$ (not significant).

Table (4.6) Cross-tabulation of Pain Management Training and Knowledge Level (N=50)

Training Status	High Knowledge	Moderate Knowledge	Low Knowledge	Total
No Training	18	23	4	45
Received Training	3	2	0	5
Total	21	25	4	50

Note. $\chi^2 = 0.984$, $df = 2$, $p = .611$ (not significant).

Table (4.7) Knowledge Scores by Education Level

Education Level	N	Mean	SD	Median	Min	Max
Diploma	9	5.44	1.51	5.0	3	8
Bachelor's Degree	41	6.44	1.14	6.0	4	8

Note. Mann-Whitney $U = 259.500$, $p = .053$ (not significant at $\alpha = .05$).

Table (4.8) Knowledge Scores by Pain Management Training Status

Training Status	N	Mean	SD	Median	Min	Max
No Training	45	6.18	1.27	6.0	3	8
Received Training	5	7.00	1.00	7.0	6	8

Note. Mann-Whitney U = 154.000, p = .172 (not significant).

Table 4.9 Overall Knowledge of Nurses

Knowledge Domain	Mean Score (out of 8)	SD	Mean Percentage (%)	SD (%)	Overall Classification	p-value
Overall Knowledge	6.26	1.26	78.25	15.73	Excellent	0.032*

*Significant at p < 0.05

Table 4.10: Distribution of Nurses by Knowledge Classification

Knowledge Level	Frequency (n)	Percentage (%)
Excellent Knowledge ($\geq 75\%$)	37	74.0
Good Knowledge (50–74%)	12	24.0
Poor Knowledge ($< 50\%$)	1	2.0
Total	50	100.0
p-value (χ^2 test)	< 0.001*	

Significant at p < 0.05

The chi-square test revealed a statistically significant difference in the distribution of knowledge levels among nurses (χ^2 (2, N=50) = 43.12, p < 0.001), indicating that most nurses had an excellent level of knowledge compared to the other categories.

DISCUSSION:

This study examined nurses' knowledge regarding postoperative pain management with the aim to assess their knowledge levels, identify factors affecting postoperative pain, determine barriers to effective pain management, and explore associations between demographic variables and knowledge performance. The findings revealed that nurses demonstrated a moderately good overall knowledge level, with a mean score of 6.26 out of 8 (78.2%), though significant gaps persisted in pharmacological management domains and most participants lacked formal pain management training (Rababa, Al-Sabbah and Hayajneh, 2021).

The overall knowledge assessment revealed that nurses achieved a mean score of 78.2%, with the majority (92.0%) demonstrating at least moderate knowledge levels, as shown in Table 4.2. This finding is consistent with recent studies from Ethiopia, where Amena et al. (2024) reported that 66% of nurses demonstrated good practice in postoperative pain management, and from Saudi Arabia, where Innab, Alfauri and Alrimawi (2022) found that nurses showed moderate knowledge levels before educational intervention (M = 20.3, SD = 4.80). However, the current results contrast with studies from Qatar by Samara, Singh and O'Connor (2024), who found substantial knowledge deficits with an average score of only 48%, and from Ghana, where Adams, Varaei and Jalalinia (2020) reported poor pharmacological knowledge among diploma-level nurses. The moderately good knowledge level observed in this study may be attributed to the relatively high educational qualification of participants, with 82% holding bachelor's degrees, and their consistent clinical experience of 5–10 years in nursing practice.

The knowledge level categorization presented in Figure 4.7 demonstrated that 50% of participants achieved moderate knowledge (60-79% correct), 42% attained high knowledge ($\geq 80\%$ correct), and only 8% exhibited low knowledge ($< 60\%$ correct). This distribution is more favorable than findings from Ethiopia reported by a recent cross-sectional study, which revealed that over half of participating nurses (51.7%) had low awareness and 53.7% demonstrated poor practice in pain assessment and management (Abdelmalik et al., 2024). The relatively better performance in the current study may reflect the homogeneous sample characteristics, particularly the uniform age range (20-30 years) and consistent nursing experience, which may indicate more recent exposure to updated nursing curricula incorporating evidence-based pain management principles (Innab, Alfauri and Alrimawi, 2022).

Performance on specific knowledge items revealed significant variation across different pain management domains, as illustrated in Figures 4.8-4.15. The universal correct response (100%) to Question 21 regarding the relationship between surgery type, tissue damage, and pain severity indicates strong foundational understanding of physiological principles. Similarly, high performance on Question 23 concerning anesthesia technique selection (92.0% correct) and Question 28 addressing preoperative anxiety impact (86.0% correct) demonstrates good comprehension of procedural and psychological factors influencing postoperative pain. These findings align with recent literature emphasizing that nurses with adequate training demonstrate improved understanding of pain physiology and contributing factors (Siddiqui et al., 2025). The strong performance on basic physiological concepts reflects effective integration of foundational pain science into nursing education programs.

The weakest performance areas were identified in pharmacological management, particularly Question 26 concerning intravenous paracetamol administration (58.0% correct) and Question 25 regarding oral paracetamol and ibuprofen recommendations (66.0% correct). This finding is consistent with multiple recent studies demonstrating that pharmacology remains the weakest knowledge domain among nurses. Adams, Varaei and Jalalinia (2020) found that 68.7% of Ghanaian nurses incorrectly answered questions about nonsteroidal anti-inflammatory agents and morphine duration, while Samara, Singh and O'Connor (2024) reported widespread misconceptions about opioid selection, dosing, and conversion. A 2025 Ethiopian study similarly highlighted critical gaps in opioid safety, dose conversion, and withdrawal symptoms among nurses (webThe persistent pharmacological knowledge deficits observed across multiple international contexts suggest that pain management pharmacology is inadequately covered in nursing curricula and requires enhanced educational emphasis, particularly regarding multimodal analgesia principles that combine different medication classes to optimize pain relief while minimizing adverse effects (Graham et al., 2025).

The assessment of nurses' understanding regarding factors affecting postoperative pain revealed comprehensive recognition across multiple domains. Participants demonstrated excellent knowledge of surgical factors, with 100% correctly identifying that surgery type and tissue damage influence pain severity (Figure 4.8) and 38% recognizing invasive surgery as the primary risk factor in the multiple-choice questions (Table 4.3). This finding exceeds expectations and demonstrates better understanding than reported in several recent studies. The strong performance may reflect the participants' direct clinical experience with diverse surgical cases, enabling practical observation of how different procedures generate varying pain intensities.

Recognition of anesthetic and perioperative factors was also strong, with 92% correctly identifying that anesthesia technique selection affects pain and analgesic requirements (Figure 4.10). However, understanding of patient-related factors showed more variation, with 68% correctly answering questions about smoking history's association with higher acute postoperative pain (Figure 4.9) and 74% recognizing that preoperative chronic pain worsens acute outcomes (Figure 4.14). These findings partially align with recent systematic reviews identifying patient-related barriers to pain management, including communication difficulties, hemodynamic instability, and substance abuse history (Rababa, Al-Sabbah and Hayajneh, 2021). The moderate performance on smoking-related questions suggests this specific risk factor requires additional emphasis in pain management education, as smoking significantly impacts postoperative pain through multiple physiological mechanisms including altered pain perception and inflammatory responses (Youngcharoen et al., 2023).

Although the study did not include dedicated questions specifically addressing barriers to pain management, the findings revealed several implicit barriers that align with international literature on obstacles to effective postoperative pain care. The most significant barrier identified was the lack of formal pain management training, with 90% of participants reporting no specialized education in this domain (Figure 4.6). This finding is consistent with recent studies demonstrating that inadequate training and education constitute major system-related barriers to effective pain management (Rababa, Al-Sabbah and Hayajneh, 2021; Makou et al., 2025). A 2023 African review emphasized that staff knowledge gaps represent one of the primary barriers to adequate postoperative pain management across the continent, contributing to the finding that up to 95% of surgical patients experience inadequately controlled pain (Gao et al., 2023).

The pharmacological knowledge deficits identified in Questions 25 and 26, with only 58-66% correct responses, represent nurse-related barriers that impede optimal medication administration practices. Recent literature confirms that nurses' lack of knowledge regarding pharmacological pain management, including poor understanding of analgesic pharmacokinetics and misconceptions about opioid addiction risks, constitutes a major barrier to effective care (Alotni et al., 2023). Studies have demonstrated that nurses' fears of causing opioid addiction or respiratory depression lead to systematic undermedication of patients in acute pain, despite evidence that addiction rarely occurs in the acute postoperative context when opioids are appropriately prescribed and monitored (Samara, Singh and O'Connor, 2024). The current findings suggest that addressing these knowledge gaps through structured educational interventions could significantly reduce nurse-related barriers to optimal postoperative pain management.

The varied responses to multiple-choice questions addressing management approaches (Table 4.3) suggest inconsistency in understanding of best practices, which constitutes another barrier to standardized, evidence-based care delivery. Recent studies have identified the absence of standardized guidelines and protocols for pain evaluation and control as a major system-related barrier affecting pain outcomes (Rababa, Al-Sabbah and Hayajneh, 2021). The finding that only 40% of participants identified comprehensive pain assessment as a priority nursing intervention, while responses were distributed among various single interventions, indicates fragmented understanding rather than holistic comprehension of multimodal pain management principles. This fragmentation may result in suboptimal clinical decision-making and inconsistent

patient care quality, highlighting the need for institutional protocols that guide systematic, comprehensive pain assessment and multimodal intervention approaches.

The analysis of associations between demographic variables and knowledge performance revealed no statistically significant relationships, though some trends warrant discussion. Education level showed no significant association with knowledge performance ($p = 0.053$), with bachelor's degree holders achieving a mean score of 6.44 compared to 5.44 for diploma holders (Table 4.7). This finding contrasts with several recent studies demonstrating that higher educational levels correlate with improved pain management knowledge and practices. Innab, Alfauri and Alrimawi (2022) found that nurses with baccalaureate degrees had significantly more knowledge and better attitudes regarding pain management than diploma nurses before educational intervention ($t = 3.06$, $p < .01$), while Abdelmalik et al. (2024) reported that higher education levels were significantly associated with higher awareness and practice scores in Sudan. The lack of significant association in the current study may be attributed to the small sample size ($n = 50$) with disproportionate group distribution (41 bachelor's versus 9 diploma holders), which limited statistical power to detect differences.

Pain management training showed no significant association with knowledge level categories ($p = 0.611$) or knowledge scores ($p = 0.172$), despite trained participants achieving a higher mean score of 7.00 compared to 6.18 for untrained participants (Table 4.8). This unexpected finding contradicts extensive recent evidence demonstrating that structured educational interventions significantly improve nurses' knowledge, attitudes, and practices. A 2025 study demonstrated that hybrid educational courses produced a 39.66% improvement in nursing staff knowledge after training (Siddiqui et al., 2025), while Innab, Alfauri and Alrimawi (2022) reported significant knowledge improvements following a 12-hour educational program (M increased from 20.3 to 22.2, $p < .01$). The absence of significant association in the current study is likely attributable to the extremely small number of trained participants ($n = 5$, representing only 10% of the sample), which severely limited statistical power. Additionally, the study did not assess the quality, duration, or recency of training received, factors that significantly influence training effectiveness and knowledge retention over time (Youngcharoen et al., 2023).

Gender analysis was not feasible due to the highly skewed distribution (98% female, 2% male), reflecting the typical gender composition of the nursing profession globally. This limitation prevented meaningful examination of potential gender differences in pain management knowledge, though recent literature suggests that gender may influence pain perception, assessment approaches, and management preferences. The homogeneous age distribution (100% aged 20-30 years) similarly prevented analysis of age-related variations in knowledge, though younger nurses' more recent nursing education may reflect updated curricula incorporating contemporary evidence-based pain management principles (Adams, Varaei and Jalalinia, 2020).

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REFERENCES:

1. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. *Lancet*. 2006 May 13-19;367(9522):1618-25.
2. Dunwoody CJ, Krenzschek DA, Pasero C, Rathmell JP, Polomano RC. Assessment, physiological monitoring, and consequences of inadequately treated acute pain. *J Perianesth Nurs*. 2008 Jun;23(3 Suppl 1):S15-S27.
3. Bodian CA, Freedman G, Hossain S, Eisenkraft JB, Beilin Y. The visual analog scale for pain. *Anesthesiology*. 2001 Dec;95(6):1356-61.
4. AlQadire M, AlKhalaileh M. Jordanian nurses knowledge and attitude regarding pain management. *Pain Manag Nurs*. 2014 Mar;15(1):220-8.
5. Bernardi M, Catania G, Lambert A, Tridello G, Luzzani M. Knowledge and attitudes about cancer pain management: a national survey of Italian oncology nurses. *Eur J Oncol Nurs*. 2007 Aug;11(3):272-9.
6. Ekim A, Ocakci AF. Knowledge and attitudes regarding pain management of pediatric nurses in Turkey. *Pain Manag Nurs*. 2013 Dec;14(4):e262-e267.
7. Mazda T, et al. Postoperative Pain Management. 2021. Available from: [mazda-et-al-2021-postoperative-pain-management.pdf].
8. Gao L, Mu H, Lin Y, Wen Q, Gao P. Review of the Current Situation of Postoperative Pain and Causes of Inadequate Pain Management in Africa. *J Pain Res*. 2023;16:1767–1778.