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ORIGINAL RESEARCH

Delphi Validation of a Pain Management e-Learning Module for Critical Care Nurses in Saudi Arabia

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Abstract

Background: Critical care nurses play a central role in pain management; however, persistent knowledge and competency gaps continue to affect patient outcomes globally, including in Saudi Arabia. Despite the growing adoption of e-learning in nursing education, no context-specific, expert-validated module exists for critical care pain management in this context.
Purpose: This study aimed to develop and content-validate a context-specific e-learning module on pain management to enhance critical-care nurses' competency in a regional health cluster in Saudi Arabia.
Methods: A three-round modified Delphi technique was employed. An initial needs assessment was conducted through a literature review and expert focus group input. It was then refined over three rounds with a panel of five multidisciplinary critical care specialists with 7 to 23 years of experience. Experts rated content relevance on a four-point scale. Content validity was assessed using the Content Validity Ratio (CVR) and the Content Validity Index (CVI), with retention thresholds set at CVR ≥ 0.99 and I-CVI ≥ 0.80.
Results: The Delphi process achieved 100% of retention across all rounds. Of the 25 initial content items, 24 met the CVR and I-CVI cutoffs (CVR = 1.00, I-CVI = 1.00) and were retained. One item, "Non-pharmacological interventions" (CVR = 0.60), was excluded. The final curriculum comprised six modules totaling 2.5 hours, covering pain basics and assessment; clinical aspects of pain; pharmacological management; interdisciplinary practice; case-based application; and assessment of knowledge and skills. New items suggested by the experts and included in the final curriculum were risk stratification, complication monitoring, and documentation protocols. The final scale-level CVI was 1.00.
Conclusion: This Delphi study produced an expert- and content-validated e-learning module on critical care pain management. Although strong content validity was established, the small panel size and single-region representation limit generalizability. Following pilot testing and outcome evaluation, this e-module could be used as an effective educational intervention to improve knowledge and potentially clinical practice related to pain management.

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1. Introduction

Pain is widely recognized as a critical clinical and public health priority that profoundly affects patient outcomes (Shdaifat et al., 2020). Globally, more than five million patients every year are admitted to critical care units (CCUs), with almost 77% of them reported to have complained of pain during their hospitalization (Abate et al., 2020). Much of this pain arises from necessary but noxious interventions, as over 80% of CCU pain reports have been linked to routine procedures such as wound dressing, endotracheal tube insertion, intravenous cannulation, suctioning, positioning, incision and drainage, and tracheostomy (Jamal et al., 2023). Untreated pain in the CCU can trigger harmful physiologic and psychological consequences (agitation, delirium, post-traumatic stress) that impair recovery. Unfortunately, most of the patients in the CCU are usually on mechanical ventilation, not properly oriented, or comatose, which makes them unable to communicate their concerns and desolations regarding pain (Brambilla et al.,

2025). Managing pain in sedated, comatose, and unconscious patients creates difficulty for the CCU healthcare personnel to assess the exact nature of patient pain (Nordness et al., 2021).

To address this, evidence-based guidelines, such as the Society of Critical Care Medicine's 2018 PADIS guidelines, emphasize routine pain assessment and management as fundamental components of CCU care (Devlin et al., 2018). These guidelines recommend validated pain scales (usually a 0–10 Numeric Rating Scale) for patients who can self-report, and behavioral tools such as the Critical-Care Pain Observation Tool (CPOT) and the Behavioral Pain Scale (BPS) for non-communicative patients (Devlin et al., 2018). Global initiatives have also elevated pain to a healthcare quality indicator, highlighting that effective pain management is a marker of quality care (Levy et al., 2018). For example, the Lancet Commission on palliative care and pain relief report called for urgent global action to close the "access abyss" in palliative care and pain relief, framing access to effective pain management as an essential component of universal health coverage (Knaul et al., 2018). These global views reflect the need for vigilant attention to pain treatment in all phases of care, since postponing pain treatment interferes with the healing process and can result in extended hospitalization.

Pain management in CCUs is primarily the responsibility of critical care nurses. Critical care nurses are the "first responders" and are on the frontline, seeing and managing pain (Alnajar et al., 2021). Critical care nurses spend more time at the patient's bedsides than any other healthcare providers and play a pivotal role in pain management (Ulrich et al., 2019). In this domain, the CCU nurse plays a vital role in assessing, monitoring, and managing pain, and their competency in pain assessment and management is critical to ensuring patients receive a high standard of care (Nordness et al., 2021). Nurse training is essential to enable them to recognize different types of pain, use appropriate assessment tools, and understand the nature and potential consequences of pain so that they can prevent and manage pain effectively (Grommi et al., 2023). Nurses are expected to be vigilant observers of nonverbal cues that may indicate pain in patients who are unable or reluctant to verbalize it—including changes in facial expression, agitated behaviour, guarded posture, or other body-language signs (Ghayem et al., 2023).

However, nurses internationally have been found to have inadequate knowledge and misconceptions about pain and analgesia. Grommi et al. (2023) highlighted that nursing curricula for pain assessment and management are frequently lacking, contributing to variation in care practices and consequent effects on patients' perspectives. Jaleta et al. (2021) identified that the major factor contributing to inadequate pain management among nurses was insufficient training or education, with nurses reporting feeling unprepared. Two reviews identified that pain assessment and treatment strategies were often allocated very limited time in undergraduate nursing curricula globally (Burke, 2019; Shdaifat et al., 2020), resulting in graduates having little preparation for the clinical environment. Nurses frequently underestimate pain and provide inadequate analgesia, highlighting a well-known theory–practice gap (Alanizi et al., 2025; Rababa et al., 2024). For example, knowledge deficits in pain management were identified among experienced CCU nurses who reported inadequate education in these skills (Jamal et al., 2023). One Pakistani study reported poor knowledge in pain management in over 70% of nurses working in the CCU (Shuaib, 2018). These studies emphasize the need for focused continuing education in pain management for practising nurses.

Nursing education has advanced, and health care has quickly modernized in Saudi Arabia (Saudi Vision 2030, 2022). In accordance with worldwide norms, the Ministry of Higher Education currently mandates a bachelor's degree as the prerequisite for new nurses (Albargawi et al., 2022). Research shows that gaps in pain management education persist despite these changes. According to studies of Shdaifat et al. (2020) and Alashari et al. (2026), Saudi nursing students perform poorly on standardized pain knowledge exams, with a mean accuracy often below 45%. Additionally, their knowledge levels do not regularly improve over the course of academic years. The importance of pain management was encountered only in "a few scattered lectures" during an exploration of nursing programs in Saudi Arabia; however, deficiencies in basic pharmacology and pain assessment were noted among many new graduates entering clinical practice (Alashari et al., 2026). A call to revise pain teaching content in Saudi nursing schools was recommended (Alashari et al., 2026; Alanizi et al., 2025). These knowledge deficiencies persist in the critical care nursing population, as a survey of CCU nurses found that only 7.1% had a good level of pain management knowledge (Jamal et al., 2023). An added reason for uniformity in training is that only about 32% of Saudi Arabia's CCU nursing staff are Saudi natives (Alanizi et

al., 2025). When considered collectively, the data reveal a glaring lack of pain management education among Saudi CCU nurses, likely to affect patient care.

In many critical care studies, targeted educational interventions (e.g., simulation training, case discussions, e-learning programs) have improved nurses' knowledge and confidence regarding pain, suggesting that similar training can help close the gap observed in Saudi practice (Albargawi et al., 2022). Multimedia learning resources, such as interactive scenarios and movies, have been shown to enhance nursing education results (Algahtani et al., 2020; Alshammari & Alanazi, 2023). Despite increasing recognition of the importance of effective pain management in critical care, substantial gaps persist in nurses' knowledge and clinical competencies, particularly in Saudi Arabia, where structured and standardized training remains limited. Existing educational interventions are often fragmented, inconsistently implemented, and rarely tailored to the specific demands of critical care settings. While e-learning programs have been effective in improving pain knowledge, with one study reporting that nursing students who completed an online pain-management module demonstrated marked gains in knowledge, confidence, and attitudes toward pain care (Fox et al., 2024), to the best of the authors' knowledge, no published e-learning pain management curriculum has been specifically designed for CCU nurses in Saudi Arabia. Although e-learning has emerged as a flexible and effective approach for continuing professional development, there is currently no context-specific, expert-validated e-learning module designed for critical care nurses in Saudi Arabia. Furthermore, few studies have employed rigorous consensus-based methodologies, such as the Delphi technique, to ensure both content validity and contextual relevance of educational interventions. This gap contributes to ongoing variability in pain assessment and management practices in critical care units. Therefore, this study aimed to develop and validate a pain management e-learning module using a structured Delphi approach, ensuring alignment with international best practices and local clinical needs.

2. Methods

2.1. Research design

The ADDIE paradigm (an instructional design model comprising five phases—Analysis, Design, Development, Implementation, and Evaluation) was used to guide the development of the e-learning module (Branch, 2009). In the Analysis phase, as shown in Figure 1, learning needs were identified through a focused literature review and expert focus group discussions. The Design phase involved structuring the module content and defining learning objectives. During the Development phase, the educational content was transformed into a digital prototype in collaboration with e-learning designers. The Implementation phase involved preparing the module for delivery, while the Evaluation phase was conducted using a modified Delphi technique to achieve expert consensus and content validation (Table 1).

Table 1. Reporting of the Delphi study in accordance with the CREDES (Conducting and Reporting of Delphi Studies) guideline

Domain	Checklist item	Description in this study
Research Aim	Clear rationale for Delphi use	The evaluation phase was conducted using a modified Delphi technique to achieve expert consensus and content validation
Expert Panel	Definition of expert	Experts defined as ≥5 years ICU experience and/or academic appointment
Expert Panel	Recruitment process	Purposive sampling via professional networks and institutional invitations
Expert Panel	Panel characteristics	5 experts (one critical-care physician, one pain specialist, one senior ICU nurse, and two nurse educators), with a mean experience of 11.3 years (7 – 23 years)
Anonymity	Participant anonymity ensured	Panelists blinded to identities; responses anonymized and aggregated
Rounds	Number of rounds	Three rounds conducted
Feedback	Controlled feedback	Median and IQR provided between rounds; qualitative comments summarized
Consensus	A priori definition	Consensus defined as ≥75% agreement and IQR ≤1
Stability	Stability assessment	Minimal change in median and reduction in IQR between Rounds 2 and 3
Attrition	Response rates	Round 1: 5/5 (100%); Round 2: 5/5 (100%); Round 3: 5/5 (100%)

The figure illustrates the three-stage study design aligned with the ADDIE instructional model, including analysis (content identification), design and development (module creation), and evaluation (Delphi-based validation).

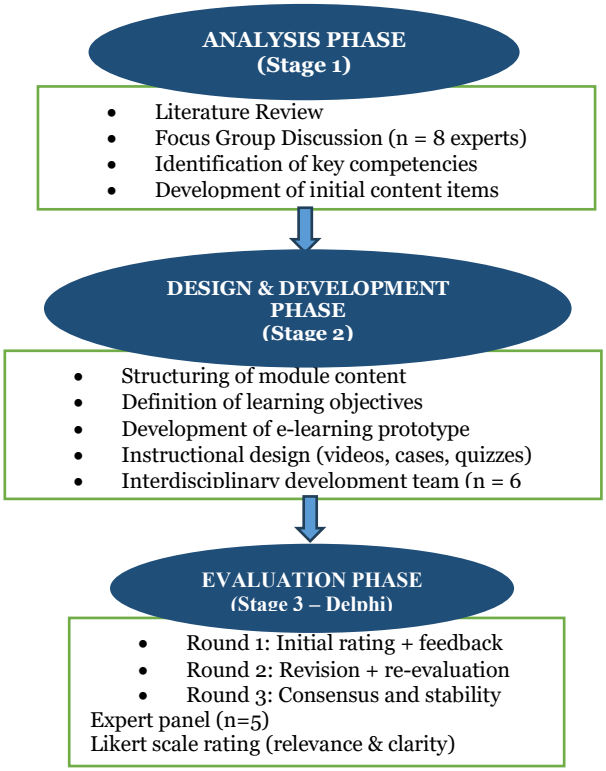

Figure 1. ADDIE-based study design for the development and validation of the pain management e-learning module

2.2. Setting and samples

This study was conducted within the Al-Qassim Health Cluster in Saudi Arabia, which comprised multiple tertiary healthcare facilities providing critical care services. The target population included healthcare professionals with expertise in critical care, pain management, and nursing education. The inclusion criteria for all stages were: (1) a minimum of five years of clinical or academic experience in critical care or pain management, and (2) involvement in education, training, or protocol development. Participants who did not meet these criteria or declined participation were excluded. Participants were recruited across three stages of the study using purposive sampling, a technique appropriate for selecting individuals with specialized knowledge relevant to the research objectives (Campbell et al., 2020).

In the first stage (analysis phase: focus group discussion), eight experts were recruited, including one critical care physician, two pain specialists, three senior critical care nurses, and two nurse educators. These participants contributed to identifying and refining the e-learning module's initial content. In the second stage (design and development phase), four experts from the focus group (one physician, one pain specialist, one senior nurse, and one nurse educator), in collaboration with two e-learning designers, formed the development team responsible for constructing the prototype module. Finally, in the third stage (evaluation phase: Delphi technique), a panel of five experts was recruited, comprising one critical care physician, one pain specialist, one senior nurse, and two nurse educators. All participants had at least 5 years of professional experience in critical care or related academic fields and prior involvement in clinical education or protocol development.

No formal sample size calculation was required for Delphi studies, although larger Delphi panels were frequently reported (Nasa et al., 2021). Methodological evidence suggests that smaller panels (5–10 experts) are appropriate and sufficient in specialized fields where participants possess high levels of expertise and are highly homogeneous (Ameyaw et al., 2016;

Nasa et al., 2021; Skulmoski et al., 2007). In such contexts, the quality of expert input is considered more critical than panel size, and smaller groups have been shown to produce reliable and valid consensus outcomes (Ameyaw et al., 2016; Nasa et al., 2021).

2.3. Measurement and data collection

Data collection was conducted across three sequential stages aligned with the ADDIE framework. In stage 1 (analysis phase: content identification), a focused literature review was conducted to identify key competencies in critical care pain management. Relevant domains included pain physiology, assessment tools, pharmacological and non-pharmacological interventions, and critical care-specific considerations. The preliminary content derived from the literature was then presented to a focus group of experts, who reviewed, refined, and contextualized the content to ensure clinical relevance. This process resulted in an initial pool of content items organized into six instructional modules.

In stage 2 (design and development phase), the refined content was structured into an e-learning module. The interdisciplinary development team determined the module structure, learning objectives, duration, and instructional strategies. The module incorporated various teaching methods, including video lectures, case-based scenarios, interactive quizzes, and discussion components, to enhance learner engagement and knowledge retention.

In stage 3 (evaluation phase: Delphi consensus process), the draft module content was circulated to the expert panel using an online questionnaire (Google Forms). A three-round modified Delphi technique was employed. In each round, panelists rated the relevance and clarity of each content item using a four-point Likert scale (1 = not relevant to 4 = highly relevant) and provided qualitative feedback. Following round 1, responses were analyzed, and items were revised based on expert feedback. New items were added to address identified gaps. In rounds 2 and 3, revised items were redistributed to the panel for re-evaluation. Controlled feedback, including summary statistics and anonymized comments, was provided between rounds to facilitate consensus. The iterative process continued until responses stabilized and consensus was achieved. Consensus was defined as at least 75% agreement among panel members, with an interquartile range (IQR) ≤ 1, indicating stable responses across rounds.

2.4. Data analysis

Data analysis was conducted across all three study stages using both qualitative and quantitative methods. In stage 1, findings from the literature review were synthesized through narrative analysis, while focus group data were analyzed thematically to identify key competencies and refine content items. In stage 2, module development followed an iterative design process guided by instructional design principles rather than formal statistical analysis. In stage 3, formal content-validation measures were calculated, and the analysis of quantitative and qualitative Delphi findings guided iterative modifications. Panel ratings were presented using descriptive statistics (item means and percentage agreement). Content validity was assessed using the Content Validity Ratio (CVR) and Item-Level Content Validity Index (I-CVI), calculated by standard methods for a five-member panel; retention thresholds were set at CVR ≥ 0.99 or I-CVI ≥ 0.80, following Lawshe's criterion (Jeldres et al., 2023). Items failing to meet consensus or validity thresholds were removed. The Percentage Agreement Score (PAS) was also used to assess agreement among panelists. It is estimated by dividing the mean score (average rating given by experts) by the maximum possible score (the highest value on the scale = 4) and multiplying the result by 100. Qualitative comments from panelists were used throughout to refine the wording, duration, sequence, and emphasis of the finalized e-module.

2.5. Ethical consideration

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of the Ministry of Health, Kingdom of Saudi Arabia (IRB Log No: H-04-Q-001). Participation in the Delphi process was voluntary. All experts agreed to participate after receiving information about the nature and purpose of the study. Informed consent was obtained from participants before they participated in the study via an online informed consent form. The experts were assured that their responses would remain anonymous and that all data would be treated as confidential.

3. Results

3.1. Content identification and module development (Stages 1 and 2)

The initial stages of the study involved identifying and developing content for the e-learning module. Through a focused literature review and expert focus group discussions, key competencies in critical care pain management were identified and structured into preliminary content areas. These included pain assessment, pharmacological and non-pharmacological management, interdisciplinary collaboration, and clinical application. Subsequently, the identified content was refined and structured into an e-learning module. Learning objectives were defined, and content was organized into six instructional modules. Appropriate instructional strategies, including video-based learning, case scenarios, and interactive assessments, were incorporated to enhance engagement and knowledge retention. The module's total duration was estimated at approximately 2.5 hours based on expert input.

The preliminary curriculum structure, including content areas, duration, and instructional approach, is presented in Table 2 (see also Supplementary Table S1 and S2).

Table 2. Initial curriculum structure (before Delphi validation)

Program Module	Content	Duration*	Teaching and Learning Methods
A. Introduction to Pain Management in Critical Care	- Importance of pain management in critically ill patients - General principles of pain management in the ICU - Key challenges in managing pain for critically ill patients	20 minutes	- Video Lecture: Overview of pain management importance and challenges. - Reading: Short summary of challenges in ICU pain management. - Discussion Forum: Participants share experiences and strategies.
B. Considerations for Critically Ill Patients	- Sedation management and its role in pain assessment - Physiological instability and its effect on pain management - Non-pharmacological interventions like relaxation, positioning, and music therapy	25 minutes	- Interactive Case Study: Apply knowledge to a hypothetical ICU patient's pain management plan. - Infographic: Visual presentation of considerations for managing pain. - Quiz: Assess understanding of sedation and non-pharmacological interventions.
C. Common Pain Management Strategies in the ICU	- Continuous intravenous opioid infusions - Patient-controlled analgesia (PCA) - Neuromuscular blockade in specific scenarios - Regional anesthesia for targeted pain relief	30 minutes	- Interactive Module: Explanation of pain management strategies with videos and examples. - Simulation: Virtual simulation of PCA and opioid infusion administration. - Discussion Board: Reflect on when to use each strategy based on patient conditions.
D. Important Aspects of ICU Pain Management	- The importance of regular pain assessment - The role of an interdisciplinary approach in pain management - The need for continuous education and awareness among healthcare providers	25 minutes	- Interactive Quiz: Test knowledge of pain assessment tools and interdisciplinary strategies. - Panel Discussion Video: Experts discuss team-based approach in pain management. - Self-Assessment: Reflect on personal learning and understanding.
E. Conclusion and Application	- Summary of pain management strategies - Key takeaways for ICU healthcare providers - Application of learning to real-world ICU cases	15 minutes	- Interactive Case Scenario: Apply key concepts in pain management. - Reflection Assignment: Write a short reflection on how to implement learned strategies in practice.
F. Evaluation of the program effectiveness	- Pre-and post-test to determine improvement in competencies (knowledge, attitudes, and competencies)	15 minutes	-

Notes. *Duration was 2 hours and 30 minutes, decided upon by the experts during the focus group session

3.2. Delphi validation (stage 3)

The evaluation phase employed a three-round modified Delphi technique to establish expert consensus and validate the e-learning module's content. A panel of five experts (N = 5) participated in all rounds, achieving a 100% response rate throughout the process. The panel had a mean of professional experience of 11.3 years in critical care and related fields. In Round 1, all initial content items demonstrated high levels of agreement, with median ratings of 4 and interquartile ranges (IQRs) of 0-1, indicating strong consensus among experts. Detailed results for round 1 are presented in Table 3. Qualitative feedback from panelists was also collected and used to refine content items and identify areas requiring further clarification. Following round 1, revisions were made based on expert input, and additional items were introduced, including risk stratification, complication monitoring, and documentation.

Table 3. Round 1 Delphi consensus results for e-learning module content validation

Module	Module Contents	PAS (%)	Mean±SD	Median (IQR)
Module A	Lecture on the importance of pain management in critically ill patients	100	4±0	4(0)
	Lecture on the general principles of pain management in the ICU	95	3.8±0.44	4(0.5)
	Lecture on key challenges in managing pain for critically ill patients	95	3.8±0.44	4(0.5)
Module B	Lecture on sedation management and its role in pain assessment	100	4±0	4(0)
	Lecture on non-pharmacological interventions like relaxation, positioning, and music therapy	90	3.6±0.54	4(1)
	Lecture on physiological instability and its effect on pain management	100	4±0	4(0)
Module C	Lecture on continuous intravenous opioid infusions: indications, titration, monitoring	100	4±0	4(0)
	Lecture on patient-controlled analgesia (PCA): principles, patient selection, safety considerations in ICU patients	100	4±0	4(0)
	Lecture on neuromuscular blockade: circumstances where it affects pain assessment and management	90	3.6±0.54	4(1)
	Lecture on regional anaesthesia for targeted pain relief	95	3.8±0.44	4(0.5)
Module D	Lecture on the importance of regular pain assessment	100	4±0	4(0)
	Lecture on the role of an interdisciplinary approach in pain management	100	4±0	4(0)
	Lecture on the need for continuous education and awareness among healthcare providers	100	4±0	4(0)
Module E	Summary of pain management strategies	100	4±0	4(0)
	Key takeaways for ICU healthcare providers	100	4±0	4(0)
	Application of learning to real-world ICU cases	100	4±0	4(0)
Module F	Pre- and post-test to determine improvement in competencies (knowledge, attitudes, and competencies)	100	4±0	4(0)
	Overall summary		3.91±0.14	4(0)

In Rounds 2 and 3, the revised items were re-evaluated, with median ratings consistently between 3 and 4 and an overall median of 4.0, reflecting sustained agreement across the panel. By the final round, 24 out of 25 items met the predefined content validity thresholds (CVR≥0.99 and I-CVI≥0.80) and were retained. One item related to non-pharmacological interventions did not meet the CVR threshold (CVR = 0.60) and was excluded. The detailed content validity results, including CVR and I-CVI values for all items, are presented in Table 4.

The final validated e-learning module comprised six structured modules totaling approximately 2.5 hours, incorporating a combination of instructional strategies and assessment components. The finalized curriculum structure is presented in Table 5.

Table 4. Rounds 2 and 3 Delphi consensus results for e-learning module content validation

Module Contents	2nd Round Score					3rd Round Score				
	%	Mean±SD	Median (IQR)	CVR	CVI	%	Mean±SD	Median (IQR)	CVR	CVI
Lecture on the importance of pain management in critically ill patients	95	3.8±0.44	4(0.5)	1	1	100	4.0±0	4(0)	1	1
Lecture on the general principles of pain management in the ICU	95	3.8±0.44	4(0.5)	1	1	90	3.6±0.54	4(1)	1	1
Lecture on key challenges in managing pain for critically ill patients	90	3.6±0.54	4(1)	1	1	90	3.6±0.54	4(1)	1	1
Briefing regarding assessing pain and pain tool assessment, especially for critical care patients*	80	3.2±0.44	3(0)	1	1	95	3.8±0.44	4(0.5)	1	1
Lecture on sedation management and its role in pain assessment	95	3.8±0.44	4(0.5)	1	1	80	3.2±0.44	3(0)	1	1
Lecture on non-pharmacological interventions like relaxation, positioning, and music therapy	90	3.6±0.54	4(1)	1	1	70	2.8±0.44	3(0.5)	0.6	0.8
Lecture on physiological instability and its effect on pain management	95	3.8±0.44	4(0.5)	1	1	100	4.0±0	4(0)	1	1
Lecture on pharmacological principles of drug therapy, patient-controlled analgesia (PCA), and reversal agents*	100	4.0±0	4(0)	1	1	95	3.8±0.44	4(0.5)	1	1
Lecture on non-pharmacological, evidence-based interventions*	80	3.2±0.44	3(0)	1	1	85	3.4±0.54	3(1)	1	1
Lecture on continuous intravenous opioid infusions: indications, titration, and monitoring	95	3.8±0.44	4(0.5)	1	1	95	3.8±0.44	4(0.5)	1	1
Lecture on patient-controlled analgesia (PCA): principles, patient selection, and safety considerations in ICU patients	95	3.8±0.44	4(0.5)	1	1	90	3.6±0.54	4(1)	1	1
Lecture on neuromuscular blockade: circumstances where it affects pain assessment and management	80	3.2±0.44	3(0)	1	1	90	3.6±0.54	4(1)	1	1
Lecture on regional anaesthesia for targeted pain relief	95	3.8±0.44	4(0.5)	1	1	95	3.8±0.44	4(0.5)	1	1
Train staff on recognising and managing potential respiratory and cardiac complications related to pain management interventions*	85	3.4±0.54	3(1)	1	1	90	3.6±0.54	4(1)	1	1
Emphasize the importance of thorough and accurate documentation of pain assessments and interventions*	95	3.8±0.44	4(0.5)	1	1	95	3.8±0.44	4(0.5)	1	1
Lecture about monitoring drugs and complications*	100	4.0±0	4(0)	1	1	100	4.0±0	4(0)	1	1

Table 4. Continued

Module Contents	2nd Round Score					3rd Round Score				
	%	Mean±SD	Median (IQR)	CVR	CVI	%	Mean±SD	Median (IQR)	CVR	CVI
Lecture on pain assessment and risk stratification to identify patients at higher risk for adverse events*	100	4.0±0	4(0)	1	1	95	3.8±0.44	4(0.5)	1	1
Lecture on the importance of regular pain assessment	95	3.8±0.44	4(0.5)	1	1	95	3.8±0.44	4(0.5)	1	1
Lecture on the role of an interdisciplinary approach in pain management	100	4.0±0	4(0)	1	1	85	3.4±0.54	3(1)	1	1
Lecture on the need for continuous education and awareness among healthcare providers	80	3.2±0.44	3(0)	1	1	90	3.6±0.54	4(1)	1	1
Lecture on barriers to effective pain management*	90	3.6±0.54	4(1)	1	1	100	4.0±0	4(0)	1	1
Summary of pain management strategies	100	4.0±0	3(0)	1	1	95	3.8±0.44	4(0.5)	1	1
Key takeaways for ICU healthcare providers	85	3.4±0.54	3(1)	1	1	100	4.0±0	4(0)	1	1
Application of learning to real-world ICU cases	85	3.4±0.54	3(1)	1	1	100	4.0±0	4(0)	1	1
Pre- and post-test to determine improvement in competencies (knowledge, attitudes, and skills)	90	3.6±0.54	4(1)	1	1	100	4.0±0	4(0)	1	1
Overall summary	91.6	3.66±0.45	4(1)	1	1	92.8	3.71±0.38	4(0)	1	1

Notes. *Indicates new added items.

ICU pain fundamentals were covered in Module 1; ICU-specific considerations (sedation, physiology, basic non-pharm approaches) were covered in Module 2; common pharmacological pain strategies were covered in Module 3; regular pain assessment, teamwork, and education were highlighted in Module 4; case-based application was provided in Module 5; and review and application were the main focus of Module 6. Consensus was reached among all experts on the inclusion of pre- and post-tests to assess competency gains, and the panel chose the evaluation component. As a result, the final version of the module includes an embedded assessment phase (a knowledge/attitudes test before and after training).

4. Discussion

This study developed and content-validated a structured e-learning module on pain management for critical care nurses using a modified Delphi approach. The final curriculum comprised of 24 validated content items organized into six modules (A to F). The high level of agreement among experts reflected strong consensus on the essential competencies required for effective pain management in critical care settings. The structured organization of the module enabled a progressive learning approach, from foundational knowledge to clinical application and evaluation. Notably, there was a paucity of prior studies focusing on a pain management module for critical care nurses, particularly within the Saudi Arabian context. Therefore, direct comparison of the overall module structure and validation outcomes remained limited. However, the module structure was in line with the findings of Almutairi and Said (2026) in their review. The review describes a pain management framework involving pain assessment, multimodal analgesia, and guideline-based protocols within the domains of knowledge, attitudes, and clinical decision-making.

To develop and validate content for an e-learning module on pain management competencies for nurses working in CCUs in Al-Qassim, Saudi Arabia, this study employed a modified Delphi technique with five experts from diverse fields. Expert consensus techniques, such as the Delphi method, were frequently used in nursing curricula to establish priorities and guidelines (Vijayananthan & Sweetlin, 2025). The results reflected both the specific educational priorities identified by regional experts and the feasibility of consensus-based approaches in specialized

healthcare contexts. By combining theory and professional judgment, the Delphi rounds distilled a comprehensive and contextually relevant curriculum that reflects best practices in curriculum development (Varndell et al., 2021).

Table 5. Final validated structure and instructional design of the e-learning module

Program Module	Content	*Duration	Teaching and learning methods
A. Introduction to Pain Management in Critical Care	- Importance of pain management in critically ill patients - General principles of pain management in the ICU - Key challenges in managing pain for critically ill patients - Briefing Regarding Assessing Pain and Pain Tool Assessment, Especially for Critical Care Patients	20 minutes	- Video Lecture: Overview of pain management importance and challenges. - Reading: Short summary of challenges in ICU pain management. - Discussion Forum: Participants share experiences and strategies.
B. Considerations for Critically Ill Patients	- Sedation management and its role in pain assessment - Physiological instability and its effect on pain management - Pharmacological Principles of Drug Therapy, Patient-Controlled Analgesia (PCA), and Reversal Agents - Non-Pharmacological, Evidence-Based Interventions	25 minutes	- Interactive Case Study: Apply knowledge to a hypothetical ICU patient's pain management plan. - Infographic: Visual presentation of considerations for managing pain. - Quiz: Assess understanding of sedation and non-pharmacological interventions.
C. Common Pain Management Strategies in the ICU	- Continuous intravenous opioid infusions - Patient-controlled analgesia (PCA) - Neuromuscular blockade in specific scenarios - Regional anaesthesia for targeted pain relief - Recognising and Managing Potential Respiratory and Cardiac Complications Related to Pain Management Interventions. - The Importance of Thorough and Accurate Documentation of Pain Assessments and Interventions. - Monitoring Drugs and Complications. - Pain Assessment and Risk Stratification to Identify Patients at Higher Risk for Adverse Events.	30 minutes	- Interactive Module: Explanation of pain management strategies with videos and examples. - Simulation: Virtual simulation of PCA and opioid infusion administration. - Discussion Board: Reflect on when to use each strategy based on patient conditions.
D. Important Aspects of ICU Pain Management	- The importance of regular pain assessment - The role of an interdisciplinary approach in pain management - The need for continuous education and awareness among healthcare providers - Barriers to Effective Pain Management.	25 minutes	- Interactive Quiz: Test knowledge of pain assessment tools and interdisciplinary strategies. - Panel Discussion Video: Experts discuss team-based approach in pain management. - Self-Assessment: Reflect on personal learning and understanding.
E. Conclusion and Application	- Summary of pain management strategies - Key takeaways for ICU healthcare providers - Application of learning to real-world ICU cases	15 minutes	- Interactive Case Scenario: Apply key concepts in pain management. - Reflection Assignment: Write a short reflection on how to implement learned strategies in practice.
F. Evaluation of the program effectiveness	- Pre-and post-test to determine improvement in competencies (knowledge, attitudes, and competencies)	15 minutes	-

Notes. *Duration was 2 hours and 30 minutes, decided upon by the experts during the focus group session

The initial modules (Modules 1 and 2) focused on foundational knowledge and pain assessment in critically ill patients. These components achieved a strong consensus among experts, reflecting their critical importance in guiding appropriate clinical decision-making. Pain assessment remains a cornerstone of effective pain management, particularly in critically ill patients who are often unable to self-report due to sedation or mechanical ventilation. This aligns with existing evidence indicating that inadequate pain assessment remains a major barrier to optimal pain management in critical care settings (Grommi et al., 2023; Jamal et al., 2023). Strong content validity metrics were obtained through the Delphi method. Lawshe's critical values indicate that for a panel of five experts, unanimous agreement is required for statistical significance (Jeldres et al., 2023). Although one item related to non-pharmacological interventions did not meet the required CVR threshold, the majority of items demonstrated strong consensus. The exclusion of this item might reflect contextual preferences in critical care settings, where pharmacological approaches were often prioritized. Complementary therapies are gaining evidence of efficacy; however, their integration into routine practice may vary depending on institutional norms and cultural acceptance (Coffee et al., 2024; Ismail et al., 2023).

Module 3 emphasized pharmacological management strategies, including continuous intravenous opioid infusions, patient-controlled analgesia, neuromuscular blockade considerations, and regional anesthesia techniques. Items related to safe opioid administration, monitoring, and complication management demonstrated consistently high agreement across Delphi rounds. This reflected the clinical priority of safe and effective analgesic use in critical care settings and aligned with international patient safety standards (Califano et al., 2026; Fazio & Firestone, 2020). The strong consensus observed was consistent with the PADIS 2018 guidelines, which recommend an "analgesia-first" approach in the management of critically ill patients (Devlin et al., 2018). Items related to patient-controlled analgesia safety, interdisciplinary teamwork, and monitoring of opioid infusions maintained stable agreement across all rounds. This consistency further reinforced the importance of safe medication practices and coordinated care in achieving optimal patient outcomes.

Modules 4 and 5 addressed interdisciplinary collaboration, documentation, continuous education, and case-based application. The inclusion of these components reflected the growing recognition of team-based approaches and structured clinical reasoning in improving patient outcomes. Items such as risk stratification, complication monitoring, and documentation were introduced based on expert feedback, highlighting the importance of contextual adaptation in curriculum development. The importance of qualitative input in Delphi processes was demonstrated by the addition of new items during Round 2, particularly those addressing clinical application and decision-making. These additions reflected the panel's emphasis on practical relevance and were consistent with Knowles' adult learning theory, which prioritizes problem-centered, experience-based learning (Knowles, 1980). Importantly, the emphasis on interdisciplinary collaboration aligns with contemporary models of patient safety, which recognize communication and teamwork as critical determinants of clinical outcomes in critical care environments (Devlin et al., 2018; Ulrich et al., 2019). The inclusion of documentation and risk stratification further reflects a shift toward systems-based practice, where accurate recording and early identification of complications are essential for continuity of care and prevention of adverse events (Califano et al., 2026; Fazio & Firestone, 2020). These competencies extend beyond individual knowledge acquisition and situate pain management within a broader clinical governance and quality improvement framework.

Furthermore, the integration of case-based applications within these modules supported the development of clinical reasoning skills, enabling nurses to translate theoretical knowledge into context-specific decision-making. This approach is particularly relevant in critical care settings, where patient conditions are dynamic and require rapid, evidence-informed responses (Nordness et al., 2021). By embedding these applied components, the module addressed the well-documented theory–practice gap in nursing education, thereby enhancing the potential for meaningful changes in clinical practice (Grommi et al., 2023; Rababa et al., 2024).

The final module (Module 6), which focused on evaluation through pre- and post-testing, received unanimous agreement from experts. This reflected the increasing emphasis on measurable learning outcomes and competency-based education in nursing professional development programs (Almutairi et al., 2025; Youngcharoen & Piyakhachornrot, 2024). The

inclusion of structured evaluation ensured that the module not only delivered knowledge but also assessed learning effectiveness and potential impact on clinical practice.

Some variability in agreement was observed for specific items, such as non-pharmacological interventions and neuromuscular blockade. This variability might reflect differences in clinical exposure and experience among panel members. For example, pain assessment in patients receiving neuromuscular blockade remained a complex challenge due to the absence of behavioral indicators, which might explain differing expert perspectives. This observation is consistent with the literature highlighting the difficulties in pain assessment in such patient populations (Laures et al., 2023). This volatility illustrates the potential influence that experts' clinical experience may have on the Delphi process, as panellists who have had direct contact with patients with chemical paralysis may have weighted this information differently than those who have not (Schifano & Niederberger, 2025). Such variability underscores the Delphi approach's ability to capture diverse expert insights and refine content accordingly.

From instructional perspectives, the final module structure reflected established educational frameworks. The progression from foundational knowledge to application and evaluation aligns with Bloom's taxonomy, supporting the development of higher-order cognitive skills required in critical care practice (Adams, 2016). Additionally, the use of interactive learning strategies, including case-based scenarios and simulations, aligned with experiential learning theory, which emphasizes active engagement and practical application of knowledge (Perusso et al., 2019; Generoso & Cassiano, 2024). In addition, the module's 2.5-hour duration reflected a deliberate balance between comprehensive content coverage and feasibility for practising nurses, aligning with the "readiness to learn" principle in adult education, which emphasized the importance of relevance and practicality in professional learning contexts (Mukhalalati & Taylor, 2019).

Overall, this study demonstrates the feasibility and effectiveness of using a modified Delphi approach to develop a context-specific, expert-validated e-learning module for critical care pain management. By integrating expert consensus, evidence-based practices, and instructional design principles, the module addresses a critical gap in nursing education and provides a structured framework to improve pain management competencies in critical care settings.

5. Implications and limitations

The developed and validated e-module provides a structured, evidence-based approach to addressing the mentioned deficiencies in the critical care pain management education in Saudi Arabia. Given the current curriculum's compliance with international guidelines and its alignment with local experts' priorities, it could serve as a model for nursing education in this region. First, its emphasis on systematic pain assessment addresses a documented competency gap, as previous studies indicate only 7.1% of Saudi CCU nurses demonstrate high-level pain management knowledge (Jamal et al., 2023). The module's focus on behavioral assessment tools for non-communicative patients directly responds to the challenge of pain assessment in sedated or mechanically ventilated patients, who constitute the majority of CCU populations. Second, patient safety goals and quality measures are supported by incorporating safety-focused information, especially regarding opioid monitoring, respiratory problem detection, and recordkeeping. According to recent pain education studies, the panel's strong consensus on these items indicates that avoidable unpleasant events should be recognized as priority learning outcomes (Chatchumni et al., 2022). Third, the e-learning model addresses real-world obstacles to nursing professional development, such as the need for uniform training across multiple institutions, shift coverage, and varying baseline competencies within a diverse workforce. The self-paced, asynchronous format satisfies the flexibility requirements of adult learners while preserving the material coherence. Fourth, beyond its application within the Saudi healthcare context, the developed e-learning module had the potential for broader international implementation. To facilitate global adoption, the module could be adapted to align with local clinical guidelines, cultural practices, and healthcare system requirements in different regions. The module's flexible, digital nature enabled scalable deployment across diverse healthcare settings, including low-resource environments where access to standardized training may be limited. Furthermore, integration of the module into nursing curricula, continuing professional development programs, and institutional training platforms can enhance its sustainability and impact. Future research should explore cross-cultural validation and contextual adaptation to ensure relevance and effectiveness in different international settings.

However, it is necessary to identify several limitations unique to this study. Most notably, non-pharmacological interventions for pain control are demonstrated to contribute to decreased opioid requirements and increased patient satisfaction profiles (Coffee et al., 2024), and their omission from the final curriculum constituted a comprehensiveness restriction. The panel size of 5 was close to the minimum requirement for statistical validity, even though it complied with methodological guidelines for homogeneous expert groups in specialized fields. The methodology required complete consensus for item retention since CVR critical values required unanimous agreement of five experts. This could lead to the exclusion of important information that was strongly supported by the panelists but not universally. Similarly, neither inter-panelist dependability nor potential dominance effects were explicitly evaluated in the study. Additionally, limiting the study to the Al-Qassim Health Cluster limited the generalizability of the results, as these experts' opinions reflected the practices, patient populations, and resources available in this cluster alone and might not apply to other health clusters in Saudi Arabia or other countries.

Due to the lack of usability testing, pilot implementation, or outcome evaluation, the value of the module as an instructional tool could not be assumed despite content validity. Rather than a proven result, the expected gain in nursing competence was a hypothesis that must be empirically tested. Scale-up readiness was hampered by the absence of a feasibility study that looked at completion rates, time-to-competency, integration with clinical workflows, or cost-effectiveness. Similarly, the module's final impact was unknown due to the lack of planned follow-up to evaluate information retention, behavioral change in clinical practice, or patient-level outcomes (pain scores, analgesic adequacy, adverse events). Future research should address these limitations through: (1) pilot testing of the modules with the target learners to evaluate for usability and immediate learning outcomes; (2) quasi-experimental and/or randomized controlled studies assessing learners' knowledge, attitudes, and self-efficacy pre- and post-intervention; (3) longer-term evaluation of learners' clinical behaviors and knowledge; and (4) patient-based studies assessing outcomes related to quality indicators in pain management following implementation of these modules. Multi-site studies with a larger, more geographically diverse panel of experts would also enhance the generalizability of the validation.

6. Conclusion

This study successfully developed and content-validated a context-specific pain management e-learning module for critical care nurses using a structured Delphi approach. The final module reflected expert consensus on six essential competencies required for effective pain assessment and management in critical care settings. By addressing identified educational gaps and aligning with international best practices, the module provides a practical and scalable tool to enhance nursing competency. Future research should evaluate its effectiveness in improving clinical practice and patient outcomes. This study provides a foundation for scalable, evidence-based digital training in critical care pain management.

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Author contribution

AA developed the main idea and contributed to drafting the manuscript, data analysis, and data interpretation. FS helped with proofreading, data interpretation, manuscript drafting, and general supervision of the manuscript.

Conflict of interest

None declared.

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Declaration of AI Use in Scientific Writing

No artificial intelligence (AI) tools were used in the conceptualization, analysis, or writing of this manuscript. All aspects of the work were conducted solely by the author.

References

Abate, S. M., Ahmed Ali, S., Mantfardo, B., & Basu, B. (2020). Rate of Intensive Care Unit admission and outcomes among patients with coronavirus: A systematic review and Meta-analysis. *Plos ONE*, *15*(7), e0235653. https://doi.org/10.1371/journal.pone.0235653

Adams, N. E. (2016). Bloom's taxonomy of cognitive learning objectives. *Journal of the Medical Library Association: JMLA*, *103*(3), 152–153. https://doi.org/10.3163/1536-5050.103.3.010

Alanizi, A. W., Shaqiqi, W., Cabaldo, L. C., Awaji, R. M., Alotaibi, R. A., & Alanazi, A. M. (2025). Nurses' knowledge and attitudes toward pain assessment and management: A cross-sectional study. *Nursing Research and Practice*, *2025*, 6646998. https://doi.org/10.1155/nrp/6646998

Alashari, R., Alasmari, M., Alsheikh, M., Alharthy, B., & Tayeb, B. (2026). Knowledge and attitude of nursing students toward pain management and opioids: A cross-sectional survey in the western region Saudi Arabia. *Saudi Journal of Anaesthesia*, *20*(1), 126–130. https://doi.org/10.4103/sja.sja_643_25

Albargawi, M., Albaz, N., Alyousif, S., & Alzahem, A. (2022). International trends of nursing career path: A systematic review. *Saudi Journal for Health Sciences*, *11*(1), 1. https://doi.org/10.4103/sjhs.sjhs_28_22

Algahtani, H., Shirah, B., Subahi, A., Aldarmahi, A., Ahmed, S. N., & Khan, M. A. (2020). Perception of Students about e-learning: A single-center experience from Saudi Arabia. *Dr. Sulaiman al Habib Medical Journal*, *2*(2), 65–71. https://doi.org/10.2991/dsahmj.k.200327.001

Almutairi, A., & Said, F. M. (2026). Pain management frameworks and critical care nursing competencies: An evidence-informed integrative review. *Cureus, 18*(3), e105039. https://doi.org/10.7759/cureus.105039

Almutairi, A., Said, F., & Mulud, Z. (2025). Effect of pain management educational program on competency of critical care area nurses: A systematic review. *International Journal of Medical Science and Dental Health*, *11*(04), 25–42. https://doi.org/10.55640/ijmsdh-11-04-04

Alnajar, M. Kh., Shudifat, R., Mosleh, S. M., Ismaile, S., N'erat, M., & Amro, K. (2021). Pain assessment and management in intensive care unit: Nurses' practices, perceived influencing factors, and educational needs. *The Open Nursing Journal*, *15*(1), 170–178. https://doi.org/10.2174/1874434602115010170

Alshammari, K. F., & Alanazi, M. F. (2023). Use of technology in enhancing learning among nurses in Saudi Arabia; A Systematic review. *Journal of Multidisciplinary Healthcare*, *16*, 1587–1599. https://doi.org/10.2147/jmdh.s413281

Ameyaw, E. E., Hu, Y., Shan, M., Chan, A. P. C., & Le, Y. (2016). Application of the Delphi method in construction engineering and management research: A Quantitative perspective. *Journal of Civil Engineering and Management*, *22*(8), 991–1000. https://doi.org/10.3846/13923730.2014.945953

Brambilla, S., Ausili, D., Locatelli, G., Di Mauro, S., Bellani, G., & Luciani, M. (2025). Communication difficulties in mechanically ventilated voiceless patients in intensive care units: A qualitative study. *Nursing in Critical Care*, *30*(3), e70037. https://doi.org/10.1111/nicc.70037

Branch, R. M. (2009). *Instructional design: The ADDIE approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Burke, A. (2019). *Submission to the Australian Government Department of Health. Review of nursing education educating the nurse of the future (the review) - Independent review of nursing education*. The Australian Pain Society. https://consultations.health.gov.au/office-of-the-chief-nursing-and-midwifery-officer/educating-the-nurse-of-the-future-independent-revi1/supporting_documents/Maunsell_T%20Burke_A%20Wallace_D_Australian%20Pain%20Society%20Limited.PDF

Califano, A., Caldonazzo, R., Gotti, M., Sabbatini, G., Galimberti, A., Angelo, P., & Formenti, P. (2026). Patient-controlled analgesia in ICU: A scoping review. *Journal of Personalized Medicine*, *16*(2), 109. https://doi.org/10.3390/jpm16020109

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: Complex or simple? Research case examples.

Journal of Research in Nursing, *25*(8), 652–661. https://doi.org/10.1177/1744987120927206

Chatchumni, M., Eriksson, H., & Mazaheri, M. (2022). Core components of an effective pain management education programme for surgical nurses: A Delphi study. *International Journal of Qualitative Studies on Health and Well-being, 17*(1), 2110672. https://doi.org/10.1080/17482631.2022.2110672

Coffee, Z., Cheng, K., Slebodnik, M., Mulligan, K., Yu, C. H., Vanderah, T. W., & Gordon, J. S. (2024). The impact of non-pharmacological interventions on opioid use for chronic noncancer pain: A scoping review. *International Journal of Environmental Research and Public Health*, *21*(6), 794. https://doi.org/10.3390/ijerph21060794

Devlin, J. W., Skrobik, Y., Gélinas, C., Needham, D. M., Slooter, A. J. C., Pandharipande, P. P., Watson, P. L., Weinhouse, G. L., Nunnally, M. E., Rochwerg, B., Balas, M. C., van den Boogaard, M., Bosma, K. J., Brummel, N. E., Chanques, G., Denehy, L., Drouot, X., Fraser, G. L., Harris, J. E., & Joffe, A. M. (2018). Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. *Critical Care Medicine*, *46*(9), 825–873. https://doi.org/10.1097/ccm.0000000000003299

Fazio, S., & Firestone, R. (2020). *Fatal patient-controlled analgesia (PCA) opioid-induced respiratory depression*. Agency for Healthcare Research and Quality. https://psnet.ahrq.gov/web-mm/fatal-patient-controlled-analgesia-pca-opioid-induced-respiratory-depression

Fox, H., K, Shrestha, S., Dahlke, S., Butler, J. I., Hunter, K., Fox, M. T., Davidson, S., Chasteen, A. L., & Moody, E. (2024). Nursing students' perceptions of a pain management e-learning module: An exploratory quantitative study. *Pain Management Nursing Official Journal of the American Society of Pain Management Nurses*, *25*(2), E138–E143. https://eurekamag.com/research/091/002/091002611.php

Generoso, L., & Cassiano, F. (2024). The approach to experiential learning by David Kolb and its influence on the development of professional competencies in leadership. *Contribuciones a Las Ciencias Sociales*, *17*(10), e12179. https://doi.org/10.55905/revconv.17n.10-474

Ghayem, H., Heidari, M., Aghaei, B., & Norouzadeh, R. (2023). The effect of training the Nonverbal Pain Scale (NVPS) on the ability of nurses to monitor the pain of patients in the intensive care unit. *Indian Journal of Critical Care Medicine*, *27*(3), 195–200. https://doi.org/10.5005/jp-journals-10071-24425

Grommi, S., Vaajoki, A., Voutilainen, A., & Kankkunen, P. (2023). Effect of pain education interventions on registered nurses' pain management: A systematic review and meta-analysis. *Pain Management Nursing*, *24*(4), 456–468. https://doi.org/10.1016/j.pmn.2023.03.004

Ismail, N., Alhammad, A., Alshaya, A., Alkhani, N., Alenazi, A., & Aljuhani, O. (2023). Characteristics of critical care pharmacy services in Saudi Arabia. *Journal of Multidisciplinary Healthcare*, *16*, 3227–3234. https://doi.org/10.2147/jmdh.s434116

Jaleta, D. T., Tuji, T. S., & Wake, A. D. (2021). Knowledge and associated factors towards post-operative pain management among nurses working at referral hospitals, Ethiopia. *Open Journal of Pain Medicine*, *5*(1), 001–007. https://doi.org/10.17352/ojpm.000023

Jamal, K., Alameri, R., Alqahtani, F., AlGarni, R., Alamri, N., Elshnawie, H., Badawi, S., & Hussien, A. (2023). Knowledge and attitudes of critical care nurses regarding pain management in Saudi Arabia. *Medical Archives*, *77*(1), 49. https://doi.org/10.5455/medarh.2023.77.49-55

Jeldres, M. R., Costa, E. D., & Faouzi, T. (2023). A review of Lawshe's method for calculating content validity in the social sciences. *Frontiers in Education*, *8,* 1271335. https://doi.org/10.3389/feduc.2023.1271335

Knaul, F. M., Farmer, P. E., Krakauer, E. L., De Lima, L., Bhadelia, A., Jiang Kwete, X., Arreola-Ornelas, H., Gómez-Dantés, O., Rodriguez, N. M., Alleyne, G. A. O., Connor, S. R., Hunter, D. J., Lohman, D., Radbruch, L., del Rocío Sáenz Madrigal, M., Atun, R., Foley, K. M.,Frenk, J., Jamison, D. T., & Rajagopal, M. R. (2018). Alleviating the access abyss in palliative care and pain relief—an imperative of universal health coverage: The Lancet Commission report. *The Lancet*, *391*(10128), 1391–1454. https://doi.org/10.1016/s0140-6736(17)32513-8

Knowles, M. S. (1980). *The modern practice of adult education: From pedagogy to andragogy*. (2nd ed.). Prentice Hall/Cambridge.

Laures, E., LaFond, C. M., Marie, B. St., & McCarthy, A. M. (2023). Pain Assessment and management for a chemically paralyzed child receiving mechanical ventilation. *American Journal of Critical Care*, *32*(5), 346–354. https://doi.org/10.4037/ajcc2023403

Levy, N., Sturgess, J., & Mills, P. (2018). "Pain as the fifth vital sign" and dependence on the "numerical pain scale" is being abandoned in the US: Why?. *British Journal of Anaesthesia*, *120*(3), 435–438. https://doi.org/10.1016/j.bja.2017.11.098

Mukhalalati, B. A., & Taylor, A. (2019). Adult learning theories in context: A quick guide for healthcare professional educators. *Journal of Medical Education and Curricular Development*, *6*, 26. https://doi.org/10.1177/2382120519840332

Nasa, P., Jain, R., & Juneja, D. (2021). Delphi methodology in healthcare research: How to decide its appropriateness. *World Journal of Methodology*, *11*(4), 116–129. https://doi.org/10.5662/wjm.v11.i4.116

Nordness, M. F., Hayhurst, C. J., & Pandharipande, P. (2021). Current perspectives on the assessment and management of pain in the intensive care unit. *Journal of Pain Research*, *14*(14), 1733–1744. https://doi.org/10.2147/JPR.S256406

Perusso, A., Blankesteijn, M., & Leal, R. (2019). The contribution of reflective learning to experiential learning in business education. *Assessment & Evaluation in Higher Education*, *45*(7), 1–15. https://doi.org/10.1080/02602938.2019.1705963

Rababa, M., Tawalbeh, R., & Abu-Zahra, T. (2024). Nurses' perception of uncertainty regarding suspected pain in people with dementia: A qualitative descriptive study. *PloS One*, *19*(4), e0300517. https://doi.org/10.1371/journal.pone.0300517

Saudi Vision 2030. (2022). *Health sector transformation program*. Vision 2030.gov.sa. https://www.vision2030.gov.sa/en/explore/programs/health-sector-transformation-program

Schifano, J., & Niederberger, M. (2025). How Delphi studies in the health sciences find consensus: A scoping review. *Systematic Reviews*, *14*, 14. https://doi.org/10.1186/s13643-024-02738-3

Shdaifat, E., Al-Shdayfat, N., & Sudqi, A. (2020). Saudi nursing students' pain management knowledge and attitudes. *Nursing Open*, *7*(6), 1833–1839. https://doi.org/10.1002/nop2.570

Shuaib, N. (2018). Nurses' knowledge regarding pain management among patients in critical care units. *Journal of Clinical Anesthesiology*, *2*(2), 106.

Skulmoski, G. J., Hartman, F. T., & Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education: Research*, *6*(6), 001-021. https://doi.org/10.28945/199

Ulrich, B., Barden, C., Cassidy, L., & Varn-Davis, N. (2019). Critical care nurse work environments 2018: Findings and implications. *Critical Care Nurse*, *39*(2), 67–84. https://doi.org/10.4037/ccn2019605

Varndell, W., Fry, M., & Elliott, D. (2021). Applying real-time Delphi methods: Development of a pain management survey in emergency nursing. *BMC Nursing*, *20*(1), 149. https://doi.org/10.1186/s12912-021-00661-9

Vijayananthan, S. L., & Sweetlin, I. (2025). Delphi method in nursing research. *Indian Journal of Continuing Nursing Education*, *26*(1), 17–21. https://doi.org/10.4103/ijcn.ijcn_76_25

Youngcharoen, P., & Piyakhachornrot, C. (2024). Online learning to improve nurses' knowledge, attitudes, and self-efficacy about managing postoperative pain in older adults. *Pain Management Nursing*, *25*(3), 249–257. https://doi.org/10.1016/j.pmn.2024.02