JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S9

Systematic Review to Assess Effect of Educational Interventions for Improving the Nurses' Knowledge, Pediatric Pain Management

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ABSTRACT

Background:
Despite advancements in pain management research and technology, pediatric post-operative pain remains inadequately addressed. Nurses, pivotal in pain assessment and management, often lack the necessary training and resources to implement effective pain relief strategies. Educational programs targeting nurses' knowledge, attitudes, and perceptions have been proposed to address these deficiencies.

Methods:
A systematic review was conducted to evaluate the impact of educational programs on pediatric nurses' competencies in post-operative pain management. Using the PICOS framework, 500 articles were initially identified from databases including CINAHL, MEDLINE, and Cochrane Library. After exclusions, 25 studies were included, 15 of which specifically examined educational interventions. Methodological quality was assessed using the Hawker et al. (2002) tool, and findings were synthesized per the PRISMA framework.

Results:
The review found strong evidence supporting the effectiveness of educational programs in improving nurses' knowledge (11 studies) and attitudes (9 studies) regarding pediatric pain management. Educational interventions demonstrated

significant positive outcomes in various countries, including Jordan, China, and Canada. However, four studies reported no significant improvements, often due to methodological limitations or high attrition rates. Programs with a focused scope and robust design yielded the most substantial impacts.

Conclusion:
Educational programs are effective in enhancing nurses' knowledge and attitudes toward pediatric post-operative pain management, contributing to improved patient outcomes. Variations in program content and delivery highlight the need for tailored, evidence-based interventions. Future research should address methodological challenges and explore long-term impacts on clinical practice.

Introduction

Despite significant advancements in pain management research, pharmacological treatments, and medical technology, numerous studies highlight that patients frequently receive inadequate pain relief (Brennan, Carr, & Cousins, 2007; Chung & Lui, 2003; Dihle, Bjølseth, & Helseth, 2006; LaFond, Van Hulle Vincent, Oosterhouse, & Wilkie, 2016; Richards & Hubbert, 2007). This issue is particularly evident in pediatric populations (Cheng, Foster, & Hester, 2003; Van Hulle Vincent, 2005; Van Hulle Vincent & Denyes, 2004), especially during the post-operative period (Twycross, 2007; Twycross, Forgeron, & Williams, 2015).

Effective pain management is a multifaceted challenge that demands collaboration between healthcare providers, particularly doctors and nurses, who play a central role in delivering patient care (Elcigil, Maltepe, Esrefgil, & Mutafoglu, 2011). As the healthcare professionals most directly involved with patients, nurses are responsible for advocating for their well-being, identifying pain early, and integrating pain relief into care plans (Cheng et al., 2003; Elcigil et al., 2011). However, studies have revealed significant shortcomings in nurses' ability to effectively manage post-operative pain (Elcigil et al., 2011; Gordon et al., 2002; Rejeh, Ahmadi, Mohamadi, Anoosheh, & Kazemnejad, 2009).

In pediatric settings, nurses often utilize pain assessment tools that are inappropriate for children's developmental stages (Welsh, 2016) and fail to consistently document pain evaluations in medical records (Ellis et al., 2007; Jordan-Marsh et al., 2004). Additionally, when medication is prescribed on an "as-needed" basis, nurses tend to administer doses below the prescribed levels, leading to under-medication (Van Hulle Vincent, 2005; Van Hulle Vincent & Denyes, 2004; Wiroopanich & Strickland, 2004). Many nurses also rely on traditional or non-pharmacological methods of pain relief that lack evidence to support their effectiveness (McCaffery, 2002). Communication issues among healthcare providers, patients, and families further contribute to inadequate pain management (Griffie, 2003; Van Niekerk & Martin, 2003), resulting in children experiencing significant post-operative pain.

While research on post-operative pain management has been extensive, it often remains a low priority for pediatric nurses in some healthcare settings. Evidence-based practices are not consistently implemented, though many nurses express a willingness to improve care. Barriers such as heavy workloads, lack of training, and insufficient emphasis on pain management education limit their ability to provide adequate care (King Khalid Hospital, 2014). To overcome these challenges, an educational program

was developed to enhance pediatric nurses' knowledge and skills in pain management. This program was designed as a self-guided, interactive module that incorporates feedback, enabling nurses to access training remotely and address the challenges posed by geographical constraints.

Methods

A systematic review was conducted to fulfill the objectives of this study. Systematic reviews are designed to identify, evaluate, and summarize findings from all relevant studies within a specific area, aiming to draw reliable conclusions about the topic under investigation through a structured, scientific approach (Aveyard, 2014; Hart, 1998; Robson, 2002). This review adhered to the guidelines established by the University of York's Centre for Reviews and Dissemination (CRD, 2009). Each study's rigor and evidence level were carefully evaluated before synthesizing the results. Adhering to systematic, scientific, and chronological steps was essential to enhance the review's reliability and reduce bias, as recommended by prior works (Abalos et al., 2001; Higgins & Green, 2011; Tacconelli, 2010).

The review question was formulated using the PICOS framework: What is the impact of an educational program (I) on pediatric nurses' knowledge, attitudes, beliefs, and perceptions of children's pain, self-efficacy, and perceived barriers to effective postoperative pain management (O) in children (P) when measured over time (S), compared to usual practice with no planned intervention (C)?

Search Strategy

A comprehensive search was performed across electronic databases, including the Cumulative Index of Nursing and Allied Health Literature (CINAHL), MEDLINE via EBSCO and Ovid SP (covering Ovid MEDLINE® from 1946 to the present with daily updates), The Cochrane Library, ProQuest, and Google Scholar. Keywords used included combinations of terms such as Child (children), Adolescent, Pediatric (Pediatric), Postoperative (Post-operative, Post surgery, Post-surgical), Pain, Self-efficacy, Attitude (Attitudes), Knowledge, Belief (Beliefs), Perception (Perceptions), Barrier (Barriers), Education, Program (Program) connected by "AND" or "OR" to maximize retrieval. The initial search took place in July and August 2014, with an update conducted in March 2016.

To meet inclusion criteria, articles had to address at least one variable stated in the research question, be written in English, report findings from experimental or quasi-experimental studies, and focus on postoperative pain in children. The restriction to English was justified as English is the primary language for academic and medical communication in Saudi Arabia, and most scientific journals publish in English.

Studies published before 2000 were excluded, based on insights from Twycross (2010) and others (Berry & Dahl, 2000) indicating this period marked increased recognition of knowledge gaps in pain management among nurses. Studies focusing on chronic rather than acute postoperative pain or those with mixed methods lacking clear differentiation between experimental components were also excluded.

Out of 500 initially retrieved articles, 229 duplicates were removed. The remaining 271 were screened against the inclusion criteria, resulting in 244 exclusions due to irrelevance. The final review included 25 studies, 15 of which specifically examined educational interventions for postoperative pain management addressing at least one relevant variable. Reporting adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework.

Table 1 Summary of studies

Study	Design & Study Instrument	Sample	Intervention	Outcomes
ıang et al., 2008	Quasi-experiment, NKAS	N = 196, China	6 hours training in the use of Changhai Pain Scale	Improved knowledge and attitude ($p < 0.001$), Knowledge & Attitude (K & A)
is et al., 2007	Quasi-experiment	N = 366, Canada	4-hour pain education workshop	Improved knowledge, attitude, and perception (K, A, & P)
hnston et al., 2007	RCT	N = 141, Canada	One-to-one coaching sessions (average 9 for each nurse)	Knowledge and attitude improvement (K & A)
ɛ et al., 2008	Quasi-experiment	N = 359, China	Booklets and nine lectures	Improved knowledge and attitude ($p < 0.001$), Knowledge & Attitude (K & A)
ɛ et al., 2010	Quasi-experiment	N = 24, Singapore	Active pain management education	Knowledge and attitude improvement (K & A)
vain et al., 2008	Quasi-experiment	N = 106, United States	Internet-based RCP (Relieve Children's Pain) protocol	Improved knowledge and attitude ($p < 0.001$), Beliefs (B), Knowledge

				(K), and Attitude (A)
ncent et al., 2010	Quasi-experiment	N = 482, United States	Small group sessions discussing case scenarios and online self-learning module	Knowledge and attitude improvement ($p < 0.001$)
Textor, 2003	Quasi-experiment	N = 53, United States	Educational intervention with a validated questionnaire	No significant differences between groups (K & A)
Dowd, 2009	Quasi-experiment	N = 106, United States	2-hour Web-Based Instructional Design Strategies/Constructivist Learning Design	Knowledge and attitude improvement ($p < 0.001$), Knowledge & Attitude (K & A)
Smith, 2007	Quasi-experiment	T1 = 65, T2 = 45, T3 = 36 nurses	Traditional education program	No significant differences between groups (K & A)

Cont. Table 1 Summary of studies

Study	Design & Study Instrument	Sample	Intervention	Outcomes
Paul, 2013	Quasi-experiment	N = 60, India	Knowledge, Attitude, Beliefs, Perception, Self-Efficacy, Barriers	Improved knowledge ($p < 0.01$)
ɒdalrahim et al., 2011	Quasi-experiment	N = 81, Jordan	Planned teaching programme	Improved knowledge and attitude ($p < 0.05$)
n et al., 2008	Quasi-experiment	N = 106, Taiwan	Postoperative pain management	Improved knowledge ($p = 0.001$) and attitude ($p = 0.005$)

			programme for three months	
uth et al., 2010	Quasi-experiment	N = 15, Mexico	4-hour Pediatric Pain Education Program (PPEP)	Improved knowledge and attitude ($p < 0.0001$)
abich et al., 2012	Quasi-experiment	N = 27 (T1), 12 (T2), 15 (T3), United States	Implementing Pediatric Pain Assessment and Management Guideline	No differences were found between before and after implementation of the guidelines

Discussion

Thirteen studies evaluated the impact of educational programs on nurses' understanding of pharmacological and non-pharmacological pain management techniques (Abdalrahim et al., 2011; Dowd, 2009; Ellis et al., 2007; Habich et al., 2012; He et al., 2008; Huth et al., 2010; Johnston et al., 2007; Lin et al., 2008; Paul, 2013; Smith, 2007; Swain, 2008; Textor & Porock, 2003; Zhang et al., 2010). Among these, eleven studies demonstrated strong evidence supporting the implementation of educational programs to improve nurses' knowledge (Dowd, 2009; Habich et al., 2012; Huth et al., 2010; Johnston et al., 2007; Lin et al., 2008; Paul, 2013; Smith, 2007; Textor & Porock, 2003; Zhang et al., 2010). Two studies provided moderate evidence for the positive impact of post-operative pain management education on children's pain knowledge (Ellis et al., 2007; He et al., 2008).

Nine studies identified a significant impact of education on nurses' knowledge. Eight of these provided strong evidence (Abdalrahim et al., 2011; Huth et al., 2010; Johnston et al., 2007; Lin et al., 2008; Paul, 2013; Swain, 2008; Textor & Porock, 2003; Zhang et al., 2010), while one presented moderate evidence (He et al., 2008). For example, a Mexican study using a non-randomized pretest-posttest design assessed a pain education program's impact on nurses' knowledge and attitudes toward children's pain ($n = 79$) and found a significant improvement ($p < .0001$) (Van Hulle Vincent et al., 2010). Similar results were observed in other countries, including Columbia (Textor & Porock, 2003), Canada (Johnston et al., 2007), the United States (Swain, 2008), Jordan (Abdalrahim et al., 2011), China (He et al., 2008; Zhang et al., 2010), India (Paul, 2013), and Taiwan (Lin et al., 2008). However, caution is advised when interpreting findings from He et al. (2008) due to a single-group design and potential confounding variables.

Conversely, four studies did not observe significant improvements in nurses' pain knowledge after educational programs (Dowd, 2009; Ellis et al., 2007; Habich et al.,

2012; Smith, 2007). These studies were generally of good quality, except for Ellis et al. (2007). The educational interventions in these studies primarily aimed to enhance nurses' knowledge of pediatric pain management, except for Smith (2007), which targeted both adult and pediatric nurses. While adult and pediatric data were analyzed separately in Smith's study, the broad nature of the intervention might have diluted its effect.

Educational program content varied considerably across the studies. Paul (2013) implemented a specialized post-operative pain education program to enhance pediatric pain management. In contrast, He et al. (2008) focused solely on non-pharmacological post-operative pain management. Other studies aimed to increase general knowledge about pediatric pain (Huth et al., 2010; Smith, 2007) or implemented broader programs targeting both adult and pediatric nurses across various hospital areas (Abdalrahim et al., 2011; Swain, 2008; Zhang et al., 2010). Lin et al. (2008) uniquely focused on relaxation therapy for surgical ward nurses.

Four studies, recruiting nurses from diverse settings, reported statistically significant positive outcomes (Abdalrahim et al., 2011; Huth et al., 2010; Lin et al., 2008; Zhang et al., 2010). High attrition rates in three studies (Dowd, 2009; Ellis et al., 2007; Habich et al., 2012) complicated the interpretation of their negative findings. Overall, 9 of 12 high-quality studies showed a statistically significant effect, supporting the conclusion that educational programs can significantly enhance nurses' knowledge of pain assessment and management.

Of fifteen studies evaluating the impact of educational programs on nurses' attitudes toward pediatric pain management, nine provided strong evidence (Abdalrahim et al., 2011; Dowd, 2009; Huth et al., 2010; Johnston et al., 2007; Lin et al., 2008; Smith, 2007; Swain, 2008; Textor & Porock, 2003; Zhang et al., 2010). Seven studies reported a positive impact on nurses' attitudes (Abdalrahim et al., 2011; Huth et al., 2010; Johnston et al., 2007; Lin et al., 2008; Swain, 2008; Textor & Porock, 2003; Zhang et al., 2010). For instance, Swain (2008) demonstrated a significant improvement in nurses' attitudes using the Knowledge and Attitudes Survey in acute care settings ($p = .0001$). Similarly, Lin et al. (2008) observed that an educational program shifted nurses' perspectives from believing post-operative pain should be endured to recognizing the need for intervention.

Eight studies combined assessments of knowledge and attitudes (Abdalrahim et al., 2011; Dowd, 2009; Huth et al., 2010; Johnston et al., 2007; Smith, 2007; Swain, 2008; Textor & Porock, 2003; Zhang et al., 2010), suggesting a potential link between the two. In all cases, significant improvements in knowledge corresponded with positive changes in attitudes. For example, Lin et al. (2008) demonstrated that a pain management education program improved both knowledge and attitudes toward relaxation therapy ($p = .005$).

Two studies with good evidence did not find statistically significant improvements in attitudes (Dowd, 2009; Smith, 2007). Smith (2007) evaluated two instructional designs (text-based versus constructivist learning) in a web-based continuing education program. The broad target audience (adult and pediatric nurses) and randomization at the individual level likely contributed to contamination between groups, limiting the

program's effectiveness. Although innovative in integrating web-based education, further replication and refinement are needed as online education systems evolve.

Overall, most studies with strong evidence reported significant improvements in nurses' attitudes, suggesting that educational programs may positively influence this aspect of pain management.

Two studies investigated the influence of pain management education programs on nurses' beliefs and perceptions about pain management. The first study, conducted in the United States, provided strong evidence (Van Hulle Vincent et al., 2010). It assessed the feasibility of the Internet-based Relieve Children's Pain protocol in improving nurses' ability to manage children's pain. Using a pre-test and post-test design, nurses completed an Internet-based Pain Beliefs and Practices Questionnaire before and after the intervention. The results showed a significant improvement in nurses' beliefs and practices scores after the intervention ($p < .0001$).

In contrast, a Canadian study with moderate evidence (Ellis et al., 2007) found no significant differences in beliefs and perceptions between the intervention and control groups after implementing an educational program aimed at enhancing pain management practices in a children's hospital. A high attrition rate, with only 35% (120 out of 344 participants) completing the post-test, likely influenced these findings. Consequently, while current evidence suggests that such programs can be effective, further research is needed to clarify their overall impact.

The literature review did not identify any studies examining the effect of pain management education programs on pediatric nurses' self-efficacy.

Perceived barriers to effective post-operative pain management in children were reported in one study with moderate evidence (Huth et al., 2010). Nurses identified heavy workloads, limited time, and challenges related to a child's inability to cooperate as common barriers. However, the study lacked a control group, which limits the strength of its findings. Additional research is necessary to address these barriers comprehensively.

The review excluded studies in languages other than English, but no relevant studies in other languages were found when this restriction was removed. Given that English is commonly used for academic research and publishing in Saudi Arabia, evidence from Saudi Arabia and the Gulf region was not excluded. The focus on experimental studies excluded qualitative evidence, which may offer valuable insights. Therefore, a separate review of qualitative studies is recommended.

The appraisal tool used, based on Hawker et al. (2002), provided structure but may mask significant design flaws when relying on overall scores. To address this, researchers carefully reviewed each study individually to mitigate potential weaknesses.

Conclusion

The review included 15 experimental studies, 13 of which provided strong evidence. Of these, 11 reported positive impacts of educational programs on nurses' knowledge, and seven out of nine studies demonstrated improvements in attitudes toward pain management. One study with strong evidence showed a positive effect of education

on nurses' beliefs and perceptions about pain management. However, no studies explored the impact of educational programs on nurses' self-efficacy, and only one moderately reliable study examined perceived barriers to effective post-operative pain management in children.

There is a lack of comprehensive studies addressing nurses' knowledge, attitudes, beliefs, self-efficacy, and perceived barriers within a single project. This review highlights significant gaps in the evidence base concerning the impact of educational programs on nurses' approaches to managing children's pain.

Policy and practice implications are evident, as inadequate pain management remains an issue despite recent efforts to adopt structured, skills-based approaches. Pediatric nurse education is critical, particularly through courses or remote, interactive self-learning packages linked to Internet resources. Although some relevant factors were identified in the literature, these need to be integrated into education initiatives.

Notably, there is a shortage of studies in Arabic-speaking regions. Only one study from Jordan was identified, and no studies have been conducted in Saudi Arabia. This review aims to inform the design of future research in Saudi Arabia.

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