

**The Effect of Educational Strategies targeted for Nurses on Pain Assessment and  
Management in Children: An Integrative Review**

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**ABSTRACT****Problem**

Nurses play an important role in children's pain assessment and management as they spend majority of the time with them and provide care on a 24-hour basis. However, research studies continue to report on nurses' inadequate assessment and management of children's pain which may be partly attributed to their insufficient education in this area.

**Purpose**

This integrative review sought to examine the effect of strategies used in educating nurses on pediatric pain assessment and management.

**Method**

Four databases were searched up to February 2018 based on a prescribed eligibility criterion. The review included 37 studies with varied methodological quality.

**Results**

Our findings revealed that various types of educational strategies improve nurses' knowledge, attitudes and practice of pain assessment, management and/ or documentation.

**Implications**

Developing a responsive program that includes expectations of beneficiaries, integrating it into existing facility training systems and delivering it through multidisciplinary collaboration offers the benefit of securing sustainability of the educational gains.

**Keywords:** pediatric patient, teaching method, learning method, pedagogy, pediatric nurse

**INTRODUCTION**

In spite of advanced technologies and research on pain (Argoff, 2014; Chiaretti et al., 2013), children continue to experience needless pain during hospitalization and in ambulatory settings (Birnie et al., 2014). Unrelieved pain in children can lead to negative psycho-physiological consequences, increased healthcare costs (Cousins, 2012; Twycross, 2010) and contribute to the development of chronic pain syndromes which may alter children's responses during future painful experiences (Bushnell, Čeko, & Low, 2013).

The pediatric pain experience presents unique challenges and opportunities due to the complex interaction of developmental, physiological, behavioral, psycho-social and situational factors which are different from adults (Jain, Yeluri, & Munshi, 2012). Children encompasses an extremely broad group from premature neonates to adolescents. Apart from marked age-related changes affecting all aspects of pain management (Mazur, Radziewicz Winnicki, & Szczepański, 2013), variations also abound in children's ability to communicate the source and intensity of their pain (Noel, Chambers, McGrath, Klein, & Stewart, 2012). Thus, they are more likely to be under-assessed and inadequately-managed for their pain (Srouji, Ratnapalan, & Schneeweiss, 2010).

Nurses spend majority of the time with hospitalized children and provide care on a 24-hour basis (Ekim & Ocakci, 2013.). Hence, they are uniquely positioned to directly affect the adequacy of children's pain management through pain assessment, planning, implementation and evaluation of interventions. However, research studies continue to report of nurses' inadequate pain assessment and management (Aziato & Adejumo, 2014). A major contributory factor to this observation is the limited education during nursing training (Abed El-Rahman, Al Kalaldehy, & Muhbes, 2013) and the lack of continuing education for nurses on pain management (Twycross, 2013).

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Education of nurses on pediatric pain assessment and management therefore, presents as one of the viable opportunities to bridge the gaps in knowledge, attitudes and practices (Huth et al., 2010). Logically, an educational program should result in learning of a desired behavior (Cilliers & Herman, 2010). Nevertheless, some studies have shown that education about pain does not always result in an improved behavior change (Francis & Fitzpatrick, 2013; Overmeer, Boersma, Denison, & Linton, 2011). Among the myriad of reasons which may account for this observation, the method of teaching has been highlighted as a major factor in determining educational outcomes (Hightower, Lloyd, & Swanson, 2011).

In our attempt to explore the research synthesis on educational interventions targeted for nurses on children's pain assessment and management, no review was found in the area. Hence, this integrative review sought to examine the effect of strategies used in educating nurses on pediatric pain assessment and management.

### **Review Questions**

1. What is the nature of published studies conducted in the field of nursing education on pediatric pain assessment and/ management?
2. What type of outcomes have been assessed from these studies?
3. Which aspects of the education contributes to its effectiveness?

## **METHODS**

### **Protocol**

Prior to the review, a detailed protocol was developed using the guidelines provided by Preferred Reporting Items for Systematic reviews and Meta-Analyses for Protocols 2015 (PRISMA-P 2015).

**Inclusion Criteria**

Experimental and non-experimental studies involving nursing educational interventions on pediatric pain assessment &/ management and their reported outcomes were eligible for inclusion.

**Search Strategy**

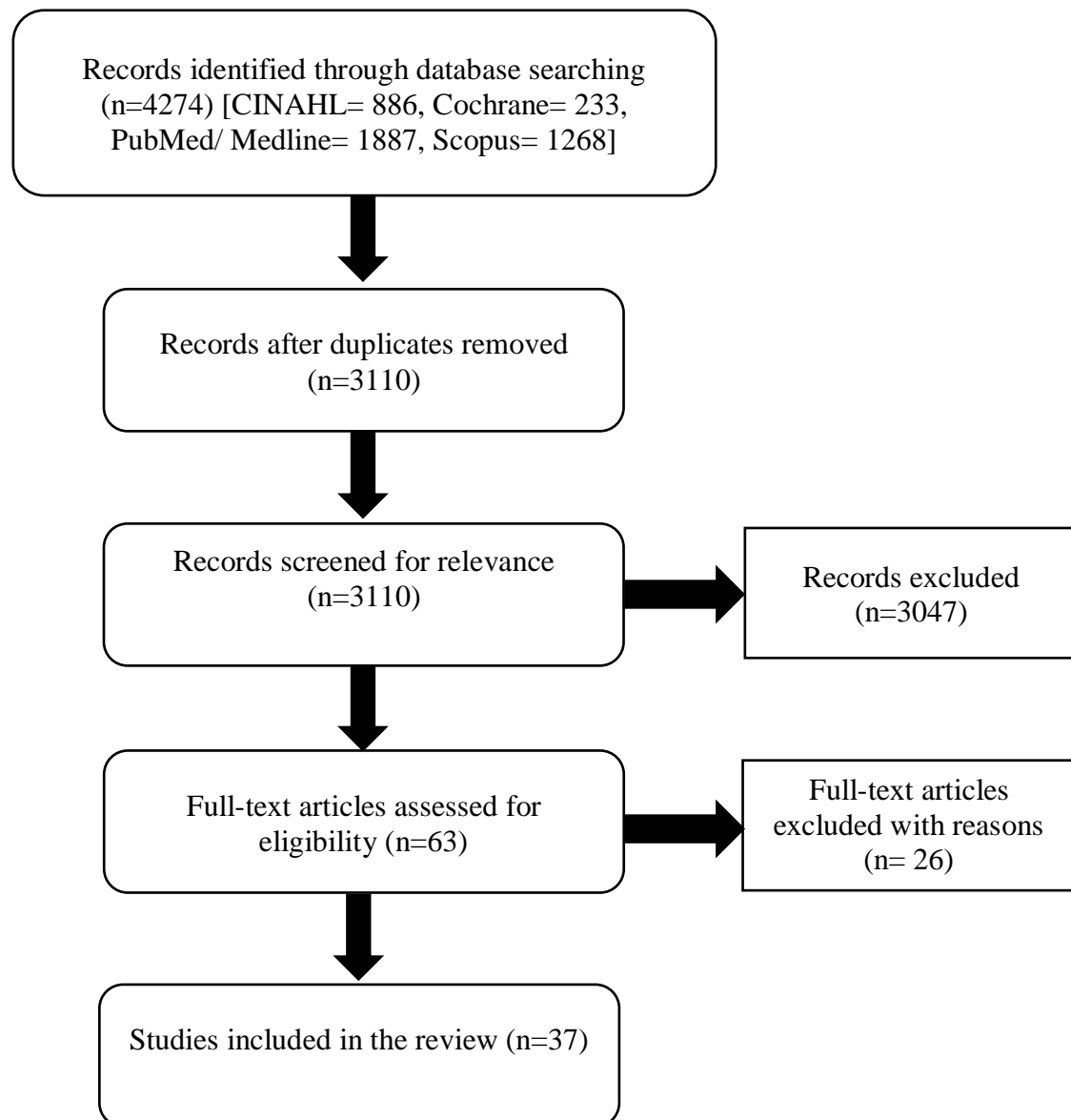
A comprehensive search was conducted on 4 databases: Cochrane Central Register of Controlled Trials (CENTRAL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed/Medline and Scopus up to February 28, 2018. The search was restricted to English, Finnish and Swedish languages.

**Search Terms**

The review questions were analysed into major components using the PICO (Population, Intervention, Comparison, and Outcome) framework (Higgins & Green, 2008) . The search was then launched with every keyword individually, and then, combined to get a larger pool of results. Due to the peculiarities of each database, the search strategy was modified as and when necessary using terms relating to nursing, midwifery, staff, student, education, pain assessment, management and children.

**Study Selection**

The retrieved studies were exported into Mendeley reference manager, after which duplicate articles were removed. The titles and abstracts of the studies were independently screened by 2 reviewers (AKA & AB) against the study's inclusion criteria. Studies for potential inclusion in the review were decided based on discussions among the reviewers. Full-text articles of all potential studies were examined by the reviewers before agreeing on the inclusion of 37 studies in this review. The process for study retrieval and selection has been presented in Figure 1.



**Figure 1. Study selection process using PRISMA**

**Note:** n – total number of studies, CINAHL – Cumulative index to nursing and allied health literature, PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses

### Critical Appraisal

Two reviewers (AKA and AB) evaluated the studies using different critical appraisal tools for the different study designs. Reviewers selected the most appropriate tool based on discussions among the research group. Each item on the appraisal tools were evaluated as “yes” (with a score of 1), “partly yes and no” (with a score of ½), and score of zero (0) for “no”, and “cannot determine” responses. In

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situations where an item had 2 sub-questions with opposing responses (ie, yes and no), the “partly yes and no” option was chosen. Items with “not applicable” responses were not scored.

The 20-item Wiley appraisal tool (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004: 234) was applied to action research studies while the 13-item Mixed Methods Appraisal Tool (Pluye, Robert, Cargo, & Bartlett, 2011) was used for such studies. Controlled intervention studies (randomised controlled trials and quasi-experimental studies with controls) and pre-post-test studies with no controls were evaluated with the National Institute of Health’s (NIH’s) quality assessment tools designed for such studies (National Heart, Lung and Blood Institute, n.d.). The total attainable appraisal score for each controlled intervention study ranged from 10 to 13 on the 14-item instrument while that of pre-post-test study with no control extended from 9 to 10 on the 12-item scale. Differences in the denominators were attributable to questions which were considered non-applicable to specific study designs, interventions and/ outcome assessment modalities.

Critical appraisal of 5 controlled intervention studies (3 randomized controlled trials and 2 quasi-experimental studies with controls), 20 pre-post-test studies with no controls, 10 action research and 2 mixed-methods were conducted. The highest attainable critical appraisal score of each study was divided by 3 and converted into percentages for standardisation purposes. The authors designed a categorization scheme since there were no published guidelines on this approach. Scores from 0 – 33.3% were graded as low (with high risk of bias), those from 33.4 – 66.7% were rated as moderate (with moderate risk of bias) and those from 66.8 – 100% as high (with low risk of bias). A consensus was reached among authors not to exclude studies on the basis of these quality categorizations.

**Data extraction**

Recommendations by the Center for Reviews and Dissemination (Tacconelli, 2010) guided data extraction and the following were retrieved from individual studies: author(s), year of publication, methodological quality rating, study design, sample characteristics, country, intervention deliverer, delivery mode, content, frequency, duration, measured outcome(s) and findings.

Classification of the delivery mode of the educational intervention was based on the template for intervention description and replication (TIDieR) guidelines (Hoffmann et al., 2014). Interventions were categorised as being delivered on the basis of: individual versus group; face-to-face, distance or combination; and being interactive or non-interactive.

The educational content was classified based on 5 central themes namely: basic principles (BP), pain assessment (PA), pharmacological pain management (PPM), nonpharmacological pain management (NPPM) and documentation (D). Basic principles covered areas such as pain definitions, types, pathophysiology, theories, benefits of pain management, brain and cognitive development of children, barriers, communication and ethico-legal considerations.

The components of the 3 major outcomes (knowledge, attitude and practice) have been described as follows: Knowledge comprised of basic facts or information on basic principles, pain assessment, pharmacological pain management, nonpharmacological pain management (NPPM) and documentation. Attitude comprised of beliefs, perception, satisfaction with pain assessment, management and/ or documentation. Practice referred to the execution of pain assessment, management and/ or documentation.



### **Data Synthesis**

Due to the methodological heterogeneity of the included studies, it was not possible to combine the individual study results for a possible meta-analysis. Thus, a narrative summary of the results was presented. Qualitative content analysis of the interventions that resulted in positive outcomes was also facilitated using NVivo version 12 software.

## **RESULTS**

The characteristics and findings of the 37 included studies have been presented in Table 1.

### **What is the nature of published studies in this field?**

Majority of the studies were quasi-experimental (22/37) and of moderate methodological quality (28/37). Studies were mainly carried out in developed countries (32/37) and published between 1996 and 2017. Slightly over a third of participants were registered nurses (14/37). Of the 29 studies that reported on the sample sizes, the numbers ranged from 10 to 366.

Sixteen percent of the educational interventions were delivered by research team member(s) (6/37) and program educators (6/37) from different healthcare disciplines. Forty-three percent of studies (16/37) did not report on the intervention deliverer. A little over half (19/37) of the interventions occurred once, whilst the frequency of 9 studies were not reported. The duration of interventions varied from less than 30 minutes to 37 hours in 25 studies; and unreported in 12 studies. Of the 27 studies that reported on the delivery mode, majority occurred in groups (23/27), were organized through face-to-face mode (22/27) and used interactive teaching and learning methods (19/27). Many of the educational content centered on basic principles of pain assessment and/ management (25/37), pain assessment (28/37), pharmacological pain management (29/37) and nonpharmacological pain management (28/37).

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Table 1. Study characteristics and findings

Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
Bildner & Krechel, 1996; USA	Action research; Nurses, paediatric residents, social worker, respiratory therapist, nutritionist; Unspecified	PTM; Unspecified; Unspecified; G, F, I; PA, PPM, NPPM	Increased compliance in pain assessment (to 100%) over 1-year period. Nurses became more assertive in asking for analgesics & better able to describe infants' pain.	Moderate; Unspecified
Howell, Foster, Hester, Vojir, & Miller, 1996; USA	Mixed method; Nurses, practical nurses, nursing assistants; Quantitative: P1=26/ 39/ 21, Qualitative: P= 3	PE; 5; 2.5 hours; G, F, I; BP, PA, PPM, NPPM	Increased nurses' knowledge, usage of the pain management forms (by 77%) & understanding of children's pain. The program's Feasibility Rating Scale (FRS) were rated as moderate in nature.	Moderate; 2–3
Pederson, 1996; USA	Controlled intervention; Paediatric nurses; P1=54, P2=35 (21 I, 14 C) & P3=24	PE; 1; 2 hours; G, F, I; NPPM	Treatment group reported improved knowledge and usage of 5 non-drug pain management techniques: breathing, relaxing, distraction, guided imagery & changing perception of painful stimuli; increased comfort in guiding children's imagery & changing their perception of painful stimuli ( $p \leq .05$ ).	High; 3
Knoblauch & Wilson, 1999; USA	Pre-post with no control group; Paediatric nurses; P1 = 52 & P2=52	Unspecified; 1; 3 hours; G, F, I;	Increased length of time before administration of first analgesic dose & between doses of analgesics to patients.	Moderate; 2

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Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
		BP, PA, PPM, NPPM, D		
Simons, 2002; UK	Action research; Paediatric nurses; P1=10 & P2=10	PE; 1; 7.25 hours; Unspecified; BP, PA, PPM, NPPM	Nurses gained knowledge on pain assessment in children. They felt their new knowledge increased their confidence & assertiveness children's pain management.	Moderate; 3
Gallo 2003; USA	Action research; Nurses; P=125	Unspecified; 1; >30 minutes; G, F, N; BP, PA, NPPM, D	Improved pain assessment adherence rate of 65% and documentation rates of 55-60% after the intervention.	High; 3
Bachiocco, Gentili, Mastrolia, Lima, & Baroncini, 2005; Italy	Pre-post with no control group; Practical nurses; P1=53 & P2=53	Unspecified; 1; 6 hours; Unspecified; BP, PA, PPM, NPPM	Improved knowledge in most pain topics (pharmacology, physiology & pain measurement) ( $p \leq .05$ ).	Moderate; 2
Chiang, Chen, & Huang, 2006; Taiwan	Pre-post with no control group; Nursing students; P1=192 & P2=181	Instructor; 1; 4 hours; G, F, I; BP, PA, PPM, NPPM	Improved knowledge (by 34.4%) of pediatric pain, attitudes, & self-efficacy (by 13.7%) in children's pain management ( $p \leq$ .05).	Low; 2
Simons & MacDonald, 2006;	Action research; Nurses;	PTM; Unspecified;	Improved usage of pain assessment tools (23-40%) & analgesic prescription.	Moderate; 4

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<b>Author(s), Year; Country</b>	<b>Study design; Participants; Sample size</b>	<b>Intervention deliverer; Frequency; Duration; Delivery mode; Content</b>	<b>Findings</b>	<b>Risk of bias; Outcome assessment frequency</b>
UK	Unspecified	Unspecified; I, F, I; PA	Nurses found the tools very easy to use with time.	
Ellis, Martelli, LaMontagne, & Splinter, 2007; Canada	Pre-post with no control group; Nurses, practical nurses; P1=366 & P2=120	Unspecified; 1; 4 hours; Unspecified; BP, PA, PPM, NPPM	Improved knowledge (by 3%), use of pain scales & documentation. No differences in the nurses' beliefs & perceptions regarding pain (p>.05).	Moderate; 2
Johnston et al., 2007; Canada	Controlled intervention; Paediatric nurses; P1=141 & P2=90	PNC; 10; Unspecified; I, F, I; PA, PPM, NPPM	Increased knowledge (by 8 points), rate of pain documented (by 43%) & usage of non-pharmacological interventions (by 11%) in the intervention group compared to a declining knowledge (by 1 point), rate of pain documentation (by 15%) & usage of non-drug measures (by 1.2%) in their controls (p≤ .05).	Moderate; >4
He, Vehvilainen- Julkunen, Pietila, & Polkki, 2008; China	Pre-post with no control group; Nurses; P1=178 & P2=181	LA; 1; Unspecified; G, F, N; BP, PA, PPM, NPPM	Increased usage of non-drug pain relieving strategies (imagery, positive reinforcement, TENS, touch & presence (p<.05), positioning, touch, presence & helping with activities of daily living).	Moderate; 2
Hong, Murphy, & Connolly, 2008; USA	Pre-post with no control group; Nurses; Unspecified	LA; 1; 20-30 minutes; G, C, I;	Increased satisfaction ratings on nurses' communication with parents/family (by 3.7%), explanations of treatments (by 4%) & pain management (by 1.6%) (p>.05).	Moderate; 2

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Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
		BP, PPM, NPPM		
Maclaren, Cohen, Larkin, & Shelton, 2008; USA	Controlled intervention; Nursing students; P1=58 & P2=50	LA; 1; 25 minutes; G, F, I; NPPM	Increased knowledge, number & quality of CBPM strategies in the intervention group relative to their controls ( $p > .05$ ). No differences between groups on attitudes toward the effectiveness of CBPM strategies ( $p > .05$ ).	Moderate; 2
Le May et al., 2009; Canada	Pre-post with no control group; Paediatric nurses; P1 = 42 & P2=21	LA; 3; 60-90 minutes; Unspecified; BP, PA, PPM, NPPM	Improved K&A ( $28.2 \pm 4.9 - 31.0 \pm 4.6$ ) ( $p < 0.05$ ), pain documentation (by 21.5-29.8%), & usage of non-pharmacological interventions (by 15.2%) ( $p < 0.05$ ).	Low; 2-3
He et al., 2010; Singapore	Pre-post with no control group; Paediatric & general nurses; P1=134 & P2=108	Unspecified; 1; 2 hours; G, F, I; BP, PA, PPM, NPPM	Heavy workload, lack of time & child's inability to cooperate were the commonly reported reasons that limited nurses' application of pain relief methods. Increased usage of 5 non-pharmacological methods (imagery, positive reinforcement, thermal regulation, massage & positioning) for children's postoperative pain relief ( $p < .05$ ).	Moderate; 2
Huth, Gregg, & Lin, 2010; Mexico	Pre-post with no control group; Nurses; P1=106 & P2=79	PE; 1; 4 hours; G, F, I;	Improved K&A ( $13.1 \pm 3.89 - 16.7 \pm 4.33$ ) post-intervention ( $p < .05$ ).	Moderate; 2

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Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
He et al., 2011; Singapore	Pre-post with no control group; Nurses; P1=134 & P2=112	BP, PA, PPM, NPPM  RT; 1; 2 hours; G, F, I; BP, PA, PPM, NPPM	No difference in all types of preparatory information provided to parents ( $p>0.05$ ). An increase in all non-pharmacological methods that were being suggested by the nurses to parents.	Moderate; 2
Van Hulle, Wilkie, & Wang, 2011; USA	Pre-post with no control group; Nurses; P1=24 & P2=21	Unspecified; 1; 2 hours; I, D, N; BP, PA, PPM	Improved pain beliefs and simulated pain management practice of nurses & a decrease in children's pain levels ( $p < .05$ ). All participants evaluated the program as easy to understand & use, organized & engaging.	Moderate; 2
Corwin, Kessler, Auerbach, Liang, & Kristinsson, 2012; USA	Action research; Nurses, physicians, patients, parents; Unspecified	Unspecified; Unspecified; Unspecified; Unspecified; BP, PA, PPM, NPPM	Median time to analgesic administration decreased by 40 minutes. Reassessment of pain by physicians increased by 70% & that of nurses by 7%. Decreased pain reports (by 6%) from the time of triage until discharge. The % of patients in pain receiving any analgesic increased by 16% & those receiving preprocedural analgesia increased by 52%. Patient satisfaction increased by 0.06.	Low; 2

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<b>Author(s), Year; Country</b>	<b>Study design; Participants; Sample size</b>	<b>Intervention deliverer; Frequency; Duration; Delivery mode; Content</b>	<b>Findings</b>	<b>Risk of bias; Outcome assessment frequency</b>
Habich et al., 2012; USA	Pre-post with no control group; Nurses; P1=27, P2=11 & P3=15	Unspecified; Unspecified; Unspecified; Unspecified; BP, PA, PPM, NPPM	No difference in nurses' K&A regarding pediatric pain ( $p>.05$ ). Increased pain assessment, use of correct tool, & reassessment ( $p<.05$ ). No difference in patient/family satisfaction ( $p>.05$ ).	Moderate; 3
Chan, Pielak, McIntyre, Deeter, & Taddio, 2013; Canada	Controlled intervention; Public health nurses; P1=53 (31 I, 22 C) & P2=43 (27 I, 16 C)	NM; 1; 2 hours; G, C, I; PPM, NPPM	Increased satisfaction, confidence with pain management & willingness to use newly recommended strategies in the intervention sites ( $p<0.05$ ).	Moderate; 2
Deindl et al., 2013; Austria	Action research; Nurses, physicians; Nurses: P1=46 & P2=42, Physicians: P1=13 & P2=19	Unspecified; Unspecified; Unspecified; G, F, I; PA	An increase in opiate prescription, pharmacologic interventions, & staff satisfaction without affecting time on mechanical ventilation, length of intensive care stay, & adverse outcomes.	Moderate; 2
Scott, Crilly, Chaboyer, & Jessup, 2013; Australia	Pre-post with no control group; Nurses; Unspecified	Nurse; 3; 1.5 hours; G, F, N; PA, PPM	Improved pain documentation (by about 7%), analgesic administration (by 7%) & usage of non-drug measures (by 8%) ( $p>.05$ ).	Moderate; 2
Nissen & Dunford 2014; UK	Action research; Nurses; Unspecified	Unspecified; Unspecified; Unspecified; Unspecified;	74% increase in pain tools in care files, 30% increase in use of pain tools, 26% increase in documentation of pain relief interventions	Moderate; 4

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Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
		Unspecified	& a 55% increase in the evaluation of interventions.	
Owens, Smith, & Jonas, 2014; UK	Controlled intervention; Nursing students; P1=127 (64 I, 63 C) & P2=82 (45 I, 37 C)	PNS; 3; 3 hours; G, F, I; BP, PPM, NPPM	Slight improvement in knowledge of the intervention group relative to their controls. Perception & attitudes towards children's pain management improved in both groups.	Moderate; 2
Reavey et al., 2014; USA	Action research; Nurses, neonatal NPs, CNSs, pharmacists, neonatal fellows, neonatologists; Unspecified	Unspecified; Unspecified; Unspecified; Unspecified	Improved pain documentation (by 39-40%).	Moderate; 3
Vael & Whitted, 2014; USA	Pre-post with no control group; Nurses, licensed practical nurses; P1=22 & P2=20	LA; 1; <30 minutes; G, F, N; PA	Improved frequency of pain assessment & documentation (p<.05). Nurses used the FLACC pain assessment tool 85% of the time when assessing pain in preverbal children.	Moderate; 3
Habich & Letizia, 2015; USA	Pre-post with no control group; ED nurses; P1=78 & P2=78	Unspecified; Unspecified; 40 minutes; I, D, N; BP, PA, PPM, NPPM	Improved knowledge (p < 0.05). 88% of all pain assessments at triage, post-intervention, & prior to discharge were documented.  54% of participants felt confident in assessing pediatric pain. 88% reported the program was effective, 96% noted the	Low; 2



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Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
			content was relevant & 78% desired to change their practice.	
Kingsnorth, Joachimides, Krog, Davies, & Higuchi, 2015; Canada	Pre-post with no control group; Nurses; P1=89 & P2=69	APN; 3; 3 hours; G, F, I; PA, PPM, NPPM	Improved K&A ( $79\% \pm 8.13$ - $83\% \pm 5.33$ ; $p < 0.05$ ). Reductions in the overall mean pain score for participants between T1 ( $5.68 \pm 2.08$ , N= 25) & T3 ( $0.98 \pm 1.32$ , N= 40) & between T2 ( $4.84 \pm 1.61$ , N= 24) & T3 ( $p < 0.05$ ).	Moderate; 2-3
Lunsford, 2015; Mongolia	Pre-post with no control group; Paediatric nurses; P1=167 & P2=155	Unspecified; 1; 2-2.5 hours; G, F, N; BP, PA, PPM, NPPM	Improved pediatric pain K&A (by 21.4%) ( $p < 0.05$ ).	Moderate; 2
Predebon et al., 2015; Brazil	Pre-post with no control group; Nurses & nurse technicians; Average of 24.2/ 57	PTM; 7; 37 hours; G, C, I; BP, PA, PPM	Improved accuracy in acute pain diagnoses (by 6.3%) ( $p < 0.05$ ). Relevance & specificity of diagnoses were moderate to high for most records.	Moderate; 2
Taddio et al., 2015; Canada	Mixed method; Nurses; Quantitative: P1=29 & P2=28, Qualitative: P1≤24	Unspecified; 2; Unspecified; G, F, I; BP, PPM, NPPM	Improved knowledge from baseline to pamphlet review phase & from the pamphlet review to the video review phase ( $p < 0.05$ ). Nurses reported being motivated to fully involve parents in procedures & were generally receptive to information contained in the tools.	Moderate; 3

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Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
Heinrich, Mechea, & Hoffmann, 2016; Germany	Pre-post with no control group; Nurses; P1=44 & P2=39	Unspecified; 3; Unspecified; Unspecified; BP, PA, PPM, NPPM	Nurses gained knowledge & skills needed in improving pain management practices.  Improved analgesic administration, control of pain measurement & usage of non-drug pain therapies (p<.05).	Moderate; 2
Ramira, Instone, & Clark, 2016; USA	Action research; Nurses, practical nurses; P=100	PE; 1; 30 minutes; G, F, N; BP, PA, PPM	Improved pain documentation at triage (by 76%) & % of patients whose pain was assessed at or before discharge (by 58%) (p<.05); shortened interval between first pain score & the time of analgesia administration (from a mean of 88 to 29 minutes) (p < 0.05); slightly shorter time between arrival at the ED & documentation of first pain score (from 17 to 16 minutes) (p = 0.876). 88% of patients had pain scores <2 at or before discharge compared to 97% of children post-education (p < 0.001).	Low; 2
Rosenberg et al., 2016; USA	Action research; Nurses, physicians, technicians; Unspecified	PE; Unspecified; Unspecified; G, F, I; BP, PPM, NPPM	Nursing pain knowledge scores increased by about 7% (77.8%-83.4%).  Over 18 months, use of topical lidocaine rose from 10% to 36.5% for all inpatient admissions.  Mean parent satisfaction around procedural comfort increased by 5% & annual mean	Low; 2

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Author(s), Year; Country	Study design; Participants; Sample size	Intervention deliverer; Frequency; Duration; Delivery mode; Content	Findings	Risk of bias; Outcome assessment frequency
Dongara, Nimbalkar, Phatak, Patel, & Nimbalkar, 2017; India	Pre-post with no control group; Nurses; P1=94, P2=90 & P3=87	Unspecified; 1; 3 hours; Unspecified; BP, PA, PPM, NPPM	score improvement correlated with the intervention with a centerline shift, with 8 consecutive points above baseline.  Improved K&A between pretest & post-test scores (15.69±2.94 vs. 17.51±3.47, p<.05) as well as the pretest & retention score (15.69±2.94 vs. 19.40±4.6, p<.05).	Moderate; 3

**Note**

**Country:** USA– United States of America, UK– United Kingdom;

**Participants:** P– Participants at a data collection point, P1– Participants at first point of data collection, P2– Participants at second point of data collection, P3– Participants at third point of data collection, I– Intervention group, C– Control group; NPs – Nurse practitioners, CNSs – Clinical nurse specialists, ED -Emergency department;

**Intervention Deliverer:** PTM– Pain team members, PE– Program educators, PNC– Pediatric nursing coaches, LA– Lead author, RT– Research team, NM– Nursing manager, PNS– Pain nurse specialist, APN– Advanced practice nurse;

**Delivery Mode:** I– Individualized, G– Group; F– Face to face, D– Distance, C– Combination; I– Interactive, N– Non-interactive

**Content:** BP– Basic principles, PA– Pain assessment, PPM– Pharmacological pain management, NPPM– Non-pharmacological pain management, D– Documentation;

**Findings:** K&A– Knowledge & attitudes, T1– First time of outcome assessment, T2– Second time of outcome assessment, T3– Third time of outcome assessment, &– and, %– Percentage, vs. – versus, APN– Advanced practice nurse, ED– Emergency department, CBPM– Cognitive-behavioral pain management, TENS– Trans-cutaneous electrical nervous stimulation, N– Number of participants, MD– Mean difference

**What type of outcomes have been assessed from these studies?**

More than half of the studies reported on knowledge (19/37), attitude (20/37) and practice (30/37) of pain assessment, management and/ or documentation.

Other outcomes that were assessed included: staff evaluation of the educational program (3/37), patient/family satisfaction with pain management (3/37), patients' pain report at discharge (1/37), duration of mechanical ventilation (1/37), length of hospital stay (1/37) and adverse outcomes of pain management interventions (1/37).

Our analysis revealed that study outcomes were mainly assessed at 2-time points (22/37) followed by 3-time points (8/37). The frequency of outcome assessment was unreported in 1 study (Bildner & Krechel, 1996).

**Which aspects of the education contributes to its effectiveness?**

Participants' knowledge improved in 18 out of the 19 studies that reported on this outcome, whereas no knowledge difference was reported in 1 study (Habich et al., 2012). However, the magnitude of knowledge improvement could not be determined due to the heterogenous nature of the study reports. Participants' attitude improved in 75% of the studies that reported on this outcome (15/20) and declined in 1 study (He et al., 2010). No difference in attitude was reported in the remaining 4 studies. The practice of pain assessment, management and/ or documentation improved in 28 out of the 30 studies and worsened in 1 study (Knoblauch & Wilson, 1999). While some aspects of practice (usage of non-pharmacological interventions) improved in the remaining study (He et al., 2011), no difference in other practice areas (nurses' provision of preparatory information to parents) was reported.

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Participants evaluated the educational program as well organized, engaging, easy to understand and use, and meeting their expectations to a moderate-high extent in 3 studies. Patient/family satisfaction improved in 2 studies (by  $\leq 5\%$ ) while, no difference was reported in 1 study. While patients' pain report at discharge improved in the only study that reported on this outcome; no difference was reported in the duration of mechanical ventilation, length of hospitalization and adverse outcomes of pain management interventions for children in pain.

Content analysis of successful interventions revealed 6 themes namely: multidisciplinary collaboration, responsive program development, well designed educational intervention, inclusiveness, system integration and measures of securing sustainability.

Multidisciplinary teams were formed and involved in activities that contributed to the success of the educational interventions. For instance, it was reported in Corwin et al.'s (2012) study that:

*“After the initial data collection, a multidisciplinary committee was formed, composed of faculty and senior house staff from the departments of pediatrics, emergency medicine, and anesthesiology, as well as nursing leadership from the child life service. The committee reviewed preintervention data and developed a pain policy, structured around areas of poor performance, changes we thought were feasible to make, and existing guidelines for care standards that were not being met”*

As part of the processes involved in developing the educational programs, several activities were undertaken to ensure that the program responds to the needs of stakeholders. These activities which justified the need for the desired change included the establishment of a pain educational needs assessment, reflection on current practices among others. Excerpts of these have been outlined as follows:

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*“Inclusion of the preliminary chart audit results were also used to justify the need for practice change ... nurses to reflect on their current practice; to help to foster the need for a change in attitudes and beliefs surrounding pain assessment and management; and to change practice for assessing pain in children with disabilities” – Kingsnorth, Joachimides, Krog, Davies, & Higuchi (2015)*

The well-designed program constituted the intervention deliverer, frequency, duration, delivery mode and content, all of which have been presented in Table 1. Other inherent features that contributed to the program’s effectiveness included: clearly defined goals, teaching and learning resources, sequencing of the educational program among others. One study reported the following:

*“... implemented in 3 stages: development of an education booklet, booklet distribution, and lecture sessions”. – He, Vehvilainen-Julkunen, Pietila & Polkki (2008)*

The success of the educational interventions can also be attributed to the inclusiveness measures that ensured that as many participants as possible were captured. This has been illustrated below:

*“The researcher employed several alternative strategies to reach more staff nurses, including posting inservice content and case study material in PEDI and PICU nurse stations, charting rooms, and staff lounges; placing a copy of the inservice hand-out and case study materials in every staff nurse’s mail box/folder; and requesting their written response regarding whether or not they read the content.” – Hong, Murphy, & Connolly (2008)*

One of the critical measures for effectiveness can be attributable to the incorporation of pain assessment and management into existing structures and systems. For instance:

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*“...the following children's pain-related instruments were approved by the institution as permanent medical records” – Howell, Foster, Hester, Vojir & Miller (1996)*

Key among the contributing factors for the educational success was the sustainability measures that were instituted to support the desired change. They mainly centered on continual engagement measures as found below:

*“Unit-based champions ... served as coaches and mentors during the implementation phase ... an advocate was designated on each shift to answer questions, solve problems, and generally instill positive attitudes among staff ... and the need for best practice pain management... feedback to and from nursing staff through members of the PRN group and the Nursing Pain Management Committee... Other transfer strategies to bring the CPMP to the bedside included presentations at nursing rounds, promotion via e-mail and hospital newsletters, unit-based pain information pegboards” – Ellis et al. (2007)*

## DISCUSSION

This integrative review is the first to examine the effect of educational interventions targeted for nurses on pediatric pain assessment and management. Drake and colleague's review described the effects of nursing educational interventions on clinical outcomes of acute pain management in hospital settings using 12 studies (Drake & de C. Williams, 2017). None of the studies used in their review was included in our study as they were not focused on children's pain assessment and management.

Our review results indicate that studies conducted in this field are predominantly quasi-experimental design with few scientifically robust designs such as randomized controlled trials (RCTs). While quasi-experimental designs are often used when researchers encounter difficulties in randomizing

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participants or working with small sample sizes, they pose some threats to establishing causality (Thyer, 2012). They are unable to sufficiently control for important confounding variables due to the lack of randomization. RCTs offer the best ways of establishing an intervention's effectiveness due to the robust nature of selecting and allocating participants to groups, and assessing outcomes (Wludyka, 2012). Hence, there is the need for more methodologically sound RCTs to be conducted in this area.

Studies included in this review were mainly of moderate methodological quality based on their total critical appraisal scores. While this approach is essential in estimating the confidence level of research findings (Harrison, Reid, Quinn, & Shenkin, 2017), it can be misleading as studies can be rated highly even when they contain potentially serious flaws (O'Connor et al., 2015). The adequacy of sample sizes in most studies were small, unjustified and unreported in some instances. All of these creates difficulties in making conclusions which can be applied in other contexts (Suresh & Chandrashekara, 2012).

Few primary studies were conducted in developing countries with none in Africa. The management of pediatric pain as a global health issue may require greater efforts in developing countries relative to developed countries because of limited resources and training deficits (Clancy, 2014). This therefore calls for extension of the research evidence in low-resourced settings in order to determine which educational interventions will be effective in making an impact.

It is also worth mentioning that majority of the educational interventions were group-based, organized via face-face and involved interactional teaching and learning approaches. While these methods are recommended as effective methods (Curran, 2014), innovative pedagogical approaches such as problem-based learning, flipped classroom, simulation among others were sparingly used in the



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included studies. As pedagogical approaches expand, it is important to evaluate how these emerging nursing educational methods affect research outcomes.

A good number of the studies did not give a comprehensive report on the educational interventions. While journal article requirements remain strict on word counts for various reasons such as preventing boredom and presenting concise information (Davis, 2014), authors should not use this as an excuse for not reporting on important elements of an intervention. It is therefore recommended for authors to consult recognized guidelines (Hoffmann et al., 2014) when reporting on interventions.

With majority of studies evaluating knowledge, attitudes and practice of pain assessment and or management, incoming studies should concentrate on the other outcomes such as program evaluation, patient and family satisfaction among others due to their limited evidence. Almost all of the studies included a baseline assessment indicator, however, it was unclear whether those results were used for planning interventions. Most follow-up assessments occurred immediately after the education with few longitudinal evaluations. It thus, remains inconclusive on the basis of this review and other literature (Beck et al., 2010; Gitlin & Czaja, 2016) to determine the best time to measure the outcome and sustenance of an educational intervention as varied time intervals yielded positive results.

The success of the education can be attributed to multidisciplinary collaboration, as this approach enables practitioners to better understand their roles and how different professions complement each other (Bedwell et al., 2012). With a growing emphasis on co-creation of interventions (Leask, Sandlund, Skelton, & Chastin, 2017), conducting an educational needs assessment in some studies served as the basis for addressing identified gaps and resulted in success as has been reported in other studies (Ekirapa-Kiracho et al., 2016; Tetui et al., 2017).

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The educational inclusiveness measures facilitated the program's appeal to learners and encapsulated many participants, all of which propelled the desired changes. In addition, the integration of children's pain assessment and management into existing structures and sustainability measures contributed immensely to the success of the educational interventions as observed in previous studies (Hanson, Salmoni, & Volpe, 2009; Tricco et al., 2016).

### **Strengths and Limitations**

Some of the strengths of this review lie in the inclusion of all study designs that were published up to 2017. Moreover, conclusions can be regarded as sound as they were based on studies with mainly moderate risk of bias.

Like many other studies, our review was not without some limitations which should be considered when analyzing the findings. We did not review the grey literature, potentially predisposing our findings to a publication bias. Our review focused on three languages, excluding many others which possibly could have enhanced the evidence generated.

### **Implications for Nursing Practice**

Various types of educational strategies improve nurses' knowledge, attitudes and practice of pain assessment and management. Developing a responsive program that includes expectations of beneficiaries, integrating it into existing facility training systems and delivering it through multidisciplinary collaboration offers the benefit of securing sustainability of educational gains. The search for which aspects of education contribute to its effectiveness should continue as this remains elusive till this present day.

This review recommends the need:

- for true experimental designs with high methodological quality in this area

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- for primary studies to be carried out in low-resource settings
- to examine innovative teaching and learning approaches in nursing research
- to report on relevant outcomes for stakeholders in children's pain assessment and management

## References

- Abed El-Rahman, M., Al Kalalkeh, M. T., & Muhbes, F (2013). Knowledge and attitude towards pain management. A comparison between oncology and non-oncology nurses in Jordan. *International Journal of Advanced Nursing Studies*, 2(2), 95-100. Retrieved from <https://doi.org/10.14419/ijans.v2i2.1006>
- Argoff, C. E. (2014). Recent management advances in acute postoperative pain. *Pain Practice*, 14(5), 477-487. Retrieved from <https://doi.org/10.1111/papr.12108>
- Aziato, L., & Adejumo, O. (2014). Determinants of nurses' knowledge gap on pain management in Ghana. *Nurse Education in Practice*, 14(2), 195-199. Retrieved from <https://doi.org/10.1016/j.nepr.2013.08.004>
- \*Bachiocco, V., Gentili, A., Mastrolia, A., Lima, M., & Baroncini, S. (2005). A pain educational program for pediatric nurses: Topics and key points. *La Pediatria Medica e Chirurgica*, 27(6), 34-37.
- Beck, C., McSweeney, J. C., Richards, K. C., Roberson, P. K., Tsai, P. F., & Souder, E. (2010). Challenges in tailored intervention research. *Nursing Outlook*, 58(2), 104-110. Retrieved from <https://doi.org/10.1016/j.outlook.2009.10.004>
- Bedwell, W. L., Wildman, J. L., DiazGranados, D., Salazar, M., Kramer, W. S., & Salas, E. (2012). Collaboration at work: An integrative multilevel conceptualization. *Human Resource Management Review*, 22(2), 128-145. Retrieved from <https://doi.org/10.1016/j.hrmr.2011.11.007>
- \*Bildner, J., & Krechel, S. W. (1996). Increasing staff nurse awareness of postoperative pain

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

management in the NICU. *Neonatal Network*, 15(1), 11-16.

Birnie, K. A., Chambers, C. T., Fernandez, C. V., Forgeron, P. A., Latimer, M. A., McGrath, P. J., ... Finley, G. A. (2014). Hospitalized children continue to report undertreated and preventable pain. *Pain Research and Management*, 19(4), 198-204. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4158935/>

Bundy, A. C., Lane, S. J., & Murray, E. A. (2002). *Sensory integration: Theory and practice* (2nd ed.). Philadelphia, USA: FA Davis Company.

Bushnell, M. C., Čeko, M., & Low, L. A. (2013). Cognitive and emotional control of pain and its disruption in chronic pain. *Nature Reviews Neuroscience*, 14(7), 502-511. Retrieved from <https://doi.org/10.1038/nrn3516>

\*Chan, S., Pielak, K., McIntyre, C., Deeter, B., & Taddio, A. (2013). Implementation of a new clinical practice guideline regarding pain management during childhood vaccine injections. *Paediatrics and Child Health*, 18(7), 367-372.

\*Chiang, L.-C., Chen, H.-J., & Huang, L. (2006). Student nurses' knowledge, attitudes, and self-efficacy of children's pain management: evaluation of an education program in Taiwan. *Journal of Pain and Symptom Management*, 32(1), 82-89. Retrieved from <https://doi.org/10.1016/j.jpainsymman.2006.01.011>

Chiaretti, A., Pierri, F., Valentini, P., Russo, I., Gargiullo, L., & Riccardi, R. (2013). Current practice and recent advances in pediatric pain management. *European Review for Medical and Pharmacological Sciences*, 17(Suppl. 1), 112-126.

Cilliers, F. J., & Herman, N. (2010). Impact of an educational development programme on teaching practice of academics at a research-intensive university. *International Journal for Academic Development*, 15(3), 253-267. Retrieved from <https://doi.org/10.1080/1360144X.2010.497698>

Clancy, M. A. (2014). Difficulty, despair and hope – an insight into the world of the health professionals treating paediatric pain in sub-saharan Africa. *Journal of Research in Nursing*,

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

19(3), 191-210. Retrieved from <https://doi.org/10.1177/1744987113486472>

Clarke, E. B., French, B., Bilodeau, M. L., Capasso, V. C., Edwards, A., & Empoliti, J. (1996). Pain management knowledge, attitudes and clinical practice: the impact of nurses' characteristics and education. *Journal of Pain and Symptom Management*, 11(1), 18-31. Retrieved from [https://doi.org/10.1016/0885-3924\(95\)00134-4](https://doi.org/10.1016/0885-3924(95)00134-4)

\*Corwin, D. J., Kessler, D. O., Auerbach, M., Liang, A., & Kristinsson, G. (2012). An intervention to improve pain management in the pediatric emergency department. *Pediatric Emergency Care*, 28(6), 524-528. Retrieved from <https://doi.org/10.1097/PEC.0b013e3182587d27>

Cousins, M. J. (2012). Unrelieved pain: A major health care priority. *Medical Journal of Australia*, 196(6), 373-374. Retrieved from <https://doi.org/10.5694/mja12.10181>

Curran, M. K. (2014). Examination of the teaching styles of nursing professional development specialists, part I: Best practices in adult learning theory, curriculum development, and knowledge transfer. *The Journal of Continuing Education in Nursing*, 45(5), 233-240. Retrieved from <https://doi.org/10.3928/00220124-20140417-04>

Davis, G. F. (2014). Editorial essay: Why do we still have journals? *Administrative Science Quarterly*, 59(2), 193-201. Retrieved from <https://doi.org/10.1177/0001839214534186>

De Rond, M. E. J., De Wit, R., Van Dam, F. S. A. M., Van Campen, B. T. M., Den Hartog, Y. M., & Klievink, R. M. A. (2000). A pain monitoring program for nurses: Effects on nurses' pain knowledge and attitude. *Journal of Pain and Symptom Management*, 19(6), 457-467. Retrieved from [https://doi.org/10.1016/S0885-3924\(00\)00128-7](https://doi.org/10.1016/S0885-3924(00)00128-7)

Deeks, J. J. (2011). Chapter 9: Analysing data and undertaking meta-analyses. In J. J. Deeks, J. P. T. Higgins & D. G. Altman (Eds.), *Cochrane handbook for systematic reviews of interventions* (Version 5.1.0). Retrieved from [https://handbook-5-1.cochrane.org/chapter\\_9/9\\_analysing\\_data\\_and\\_undertaking\\_meta\\_analyses.htm](https://handbook-5-1.cochrane.org/chapter_9/9_analysing_data_and_undertaking_meta_analyses.htm)

\*Deindl, P., Unterasinger, L., Kappler, G., Werther, T., Czaba, C., Giordano, V., ... Olischar, M.

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

(2013). Successful implementation of a neonatal pain and sedation protocol at 2 NICUs.

*Pediatrics*, 132(1), e211-e218. Retrieved from <https://doi.org/10.1542/peds.2012-2346>

\*Dongara, A. R., Nimbalkar, S. M., Phatak, A. G., Patel, D. V., & Nimbalkar, A. S. (2017). An educational intervention to improve nurses' understanding of pain in children in western India.

*Pain Management Nursing*, 18(1), 24-32. Retrieved from

<https://doi.org/10.1016/j.pmn.2016.10.003>

Drake, G., & de C. Williams, A. C. (2017). Nursing education interventions for managing acute pain in hospital settings: A systematic review of clinical outcomes and teaching methods. *Pain Management Nursing*, 18(1), 3-15. Retrieved from <https://doi.org/10.1016/j.pmn.2016.11.001>

*Management Nursing*, 18(1), 3-15. Retrieved from <https://doi.org/10.1016/j.pmn.2016.11.001>

Drendel, A. L., Kelly, B. T., & Ali, S. (2011). Pain assessment for children: Overcoming challenges and optimizing care. *Pediatric Emergency Care*, 27(8), 773-781. doi:

10.1097/PEC.0b013e31822877f7

Ekim, A., & Ocakci, A. F. (2013). Knowledge and attitudes regarding pain management of pediatric nurses in turkey. *Pain Management Nursing*, 14(4), e262-e267. Retrieved from

<https://doi.org/10.1016/j.pmn.2012.02.004>

Ekirapa-Kiracho, E., Namazzi, G., Tetui, M., Mutebi, A., Waiswa, P., Oo, H., ... George, A. S.

(2016). Unlocking community capabilities for improving maternal and newborn health:

participatory action research to improve birth preparedness, health facility access, and newborn care in rural Uganda. *BMC Health Services Research*, 16, 93-104. Retrieved from

<https://doi.org/10.1186/s12913-016-1864-x>

Ellis, J. A., Martelli, B., LaMontagne, C., & Splinter, W. (2007). Evaluation of a continuous epidural analgesia program for postoperative pain in children. *Pain Management Nursing*,

8(4), 146-155. Retrieved from

<http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=105998996&site=ehost-live>

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

- \*Ellis, J. A., McCleary, L., Blounin, R., Dube, K., Rowley, B., MacNeil, M., & Cooke, C. (2007). Implementing best practice pain management in a pediatric hospital. *Journal for Specialists in Pediatric Nursing, 12*(4), 264-277. Retrieved from <https://doi.org/10.1111/j.1744-6155.2007.00121.x>
- Francis, L., & Fitzpatrick, J. J. (2013). Postoperative pain: Nurses' knowledge and patients' experiences. *Pain Management Nursing, 14*(4), 351-357. Retrieved from <https://doi.org/10.1016/j.pmn.2012.05.002>
- \*Gallo, A. (2003). The fifth vital sign: implementation of the Neonatal Infant Pain Scale. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing, 32*(2), 199-206. Retrieved from <https://doi.org/10.1177/0884217503251745>
- Gitlin, L. N., & Czaja, S. J. (2016). *Behavioral intervention research: Designing, evaluating, and implementing*. New York: Springer Publishing Company.
- Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly, 82*(4):581-629. Retrieved from <https://doi.org/10.1111/j.0887-378X.2004.00325.x>
- \*Habich, M., & Letizia, M. (2015). Pediatric pain assessment in the emergency department: A nursing evidence-based practice protocol. *Pediatric Nursing, 41*(4), 198-202. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=108944067&site=ehost-live>
- \*Habich, M., Wilson, D., Thielk, D., Melles, G. L., Crumlett, H. S., Masterton, J., & McGuire, J. (2012). Evaluating the effectiveness of pediatric pain management guidelines. *Journal of Pediatric Nursing, 27*(4), 336-345. Retrieved from <https://doi.org/10.1016/j.pedn.2011.06.002>
- Hanson, H. M., Salmoni, A. W., & Volpe, R. (2009). Defining program sustainability: Differing views of stakeholders. *Canadian Journal of Public Health, 100*(4), 304-309. Retrieved from <https://doi.org/10.1186/1748-5908-8-117>
- Harrison, J. K., Reid, J., Quinn, T. J., & Shenkin, S. D. (2017). Using quality assessment tools to

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

critically appraise ageing research: A guide for clinicians. *Age and Ageing*, 46(3), 359-365.

Retrieved from <https://doi.org/10.1093/ageing/afw223>

\*He, H. G., Jahja, R., Lee, T. L., Ang, E. N. K., Sinnappan, R., Vehviläinen-Julkunen, K., ... MF, C. (2010). Nurses' use of non-pharmacological methods in children's postoperative pain management: Educational intervention study. *Journal of Advanced Nursing*, 66(11), 2398-2409. Retrieved from <https://doi.org/10.1111/j.1365-2648.2010.05402.x>

\*He, H. G., Jahja, R., Sinnappan, R., Ang, E. N. K., Lee, T. L., Chan, M. F., & Vehviläinen-Julkunen, K. (2011). Singaporean nurses' provision of guidance to parents on non-pharmacological postoperative pain-relief methods: An educational intervention study. *Nursing and Health Sciences*, 13(3), 344-351. Retrieved from <https://doi.org/10.1111/j.1442-2018.2011.00624.x>

\*He, H., Vehviläinen-Julkunen, K., Pietila, A., & Polkki, T. (2008). Increasing nurses' knowledge and behavior changes in nonpharmacological pain management for children in China. *Journal of Nursing Care Quality*, 23(2), 170-176. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=105904613&site=ehost-live>

\*Heinrich, M., Mechea, A., & Hoffmann, F. (2016). Improving postoperative pain management in children by providing regular training and an updated pain therapy concept. *European Journal of Pain*, 20(4), 586-593. Retrieved from <https://doi.org/10.1002/ejp.770>

Higgins, J. P., & Green, S. (2008). *Cochrane handbook for systematic reviews of interventions: Cochrane book series* (Vol. 5). doi:10.1002/9780470712184

Hightower, A. M., Lloyd, S. C., & Swanson, C. B. (2011). *Improving student learning by supporting quality teaching: Key issues, effective strategies*. Bethesda, USA: Editorial Projects in Education, Inc.

Hoffmann, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., ... Michie, S.



## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

(2014). Better reporting of interventions: Template for intervention description and replication (TIDieR) checklist and guide. *British Medical Journal*, 348, g1687. Retrieved from <https://doi.org/10.1136/bmj.g1687>

\*Hong, S. S., Murphy, S. O., & Connolly, P. M. (2008). Parental satisfaction with nurses' communication and pain management in a pediatric unit. *Pediatric Nursing*, 34(4), 306-307.

\*Howell, S. L., Foster, R. L., Hester, N. O., Vojir, C. P., & Miller, K. L. (1996). Evaluating a pediatric pain management research utilization program. *Canadian Journal of Nursing Research*, 28(2), 37-57. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=107391977&site=ehost-live>

Husband, M., & Langford, R. (2012). Advances in pain management. *Postgraduate Medical Journal*, 88(1036), 57-58. Retrieved from <https://doi.org/10.1136/postgradmedj-2011-130646>

\*Huth, M. M., Gregg, T. L., & Lin, L. (2010). Education changes Mexican nurses' knowledge and attitudes regarding pediatric pain. *Pain Management Nursing*, 11(4), 201-208. Retrieved from <https://doi.org/10.1016/j.pmn.2009.11.001>

Jain, A. a, Yeluri, R., & Munshi, A. K. (2012). Measurement and assessment of pain in children - a review. *The Journal of Clinical Pediatric Dentistry*, 37(2), 125-136. Retrieved from <https://doi.org/10.17796/jcpd.37.2.k84341490806t770>

\*Johnston, C. C., Gagnon, A., Rennick, J., Rosmus, C., Patenaude, H., Ellis, J., ... Byron, J. (2007). One-on-one coaching to improve pain assessment and management practices of pediatric nurses. *Journal of Pediatric Nursing*, 22(6), 467-478. Retrieved from <https://doi.org/10.1016/j.pedn.2007.07.004>

\*Kingsnorth, S., Joachimides, N., Krog, K., Davies, B., & Higuchi, K. S. (2015). Optimal pain assessment in pediatric rehabilitation: Implementation of a nursing guideline. *Pain Management Nursing*, 16(6), 871-880. Retrieved from

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

<https://doi.org/10.1016/j.pmn.2015.07.009>

\*Knoblauch, S. C., & Wilson, C. J. (1999). Clinical outcomes of educating nurses about pediatric pain management. *Outcomes Management for Nursing Practice*, 3(2), 87-89.

\*Le May, S., Johnston, C. C., Choinière, M., Fortin, C., Kudirka, D., Murray, L., & Chalut, D. (2009). Pain management practices in a pediatric emergency room (PAMPER) study: interventions with nurses. *Pediatric Emergency Care*, 25(8), 498-503. Retrieved from <https://doi.org/10.1097/PEC.0b013e3181b0a0af>

Leask, C. F., Sandlund, M., Skelton, D. A., & Chastin, S. F. M. (2017). Co-creating a tailored public health intervention to reduce older adults' sedentary behaviour. *Health Education Journal*, 76(5), 595-608. Retrieved from <https://doi.org/10.1177/0017896917707785>

Long, T. B. (2012). Overview of teaching strategies for cultural competence in nursing students. *Journal of Cultural Diversity*, 19(3), 102-108.

Lundeberg, S., & Lundeberg, T. (2013). Pain in infants and children – Physiological background and clinical aspects. *Acupuncture and Related Therapies*, 1(4), 46-49. Retrieved from <https://doi.org/10.1016/j.arthe.2013.05.002>

\*Lunsford, L. (2015). Knowledge and attitudes regarding pediatric pain in Mongolian nurses. *Pain Management Nursing*, 16(3), 346-353. Retrieved from <https://doi.org/10.1016/j.pmn.2014.08.007>

May, A. (2008). Chronic pain may change the structure of the brain. *Pain*, 137(1),7-15. doi: 10.1016/j.pain.2008.02.034

Mazur, A., Radziejewicz Winnicki, I., & Szczepański, T. (2013). Pain management in children. *Annals of Agricultural and Environmental Medicine*, 1, 28-34. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/25000838>

\*Maclaren, J. E., Cohen, L. L., Larkin, K. T., & Shelton, E. N. (2008). Training nursing students in evidence-based techniques for cognitive-behavioral pediatric pain management. *Journal of*

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

*Nursing Education*, 47(8), 351-358.

National Heart, Lung and Blood Institute (n.d.). Study quality assessment tools. Retrieved from

<https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools>

Noel, M., Chambers, C. T., McGrath, P. J., Klein, R. M., & Stewart, S. H. (2012). The influence of children's pain memories on subsequent pain experience. *Pain*, 153(8), 1563-1572. Retrieved from <https://doi.org/10.1016/j.pain.2012.02.020>

\*Nissen, S., & Dunford, C. (2014). Assessment of pain in children with brain injury: moving to best practice. *British Journal of Nursing*, 23(17), 930-934. Retrieved from <https://doi.org/10.12968/bjon.2014.23.17.930>

O'Connor, S. R., Tully, M. A., Ryan, B., Bradley, J. M., Baxter, G. D., & McDonough, S. M. (2015). Failure of a numerical quality assessment scale to identify potential risk of bias in a systematic review: A comparison study. *BMC Research Notes*, 8, 224. Retrieved from <https://doi.org/10.1186/s13104-015-1181-1>

Ossipov, M. H. (2012). The perception and endogenous modulation of pain. *Scientifica*, 2012, 561761. Retrieved from <https://doi.org/10.6064/2012/561761>

Overmeer, T., Boersma, K., Denison, E., & Linton, S. J. (2011). Does teaching physical therapists to deliver a biopsychosocial treatment program result in better patient outcomes? A randomized controlled trial. *Physical Therapy*, 91(5), 804-819. Retrieved from <https://doi.org/10.2522/ptj.20100079>

\*Owens, D., Smith, J., & Jonas, D. (2014). Evaluating students' knowledge of child pain and its management after attending a bespoke course. *Nursing Children and Young People*, 26(2), 34-40. Retrieved from <https://doi.org/10.7748/ncyp2014.03.26.2.34.e334>

\*Pederson, C. (1996). Nonpharmacologic interventions to manage children's pain: Immediate and short-term effects of a continuing education program. *Journal of Continuing Education in Nursing*, 27(3), 131-140.

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

- Pluye, P., Robert, E., Cargo, M., & Bartlett, G. (2011). *Mixed method appraisal tool (MMAT)* (Version 2011). Retrieved from <http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/attach/84371689/MMAT%202011%20criteria%20and%20tutorial%202011-06-29updated2014.08.21.pdf>
- \*Predebon, C. M., Cruz, D. de A. L. M. da, Matos, F. G. de O. A., Ferreira, A. M., Pasin, S., & Rabelo, E. R. (2015). Evaluation of pain and accuracy diagnostic in hospitalized children. *International Journal of Nursing Knowledge*, 23(2), 106-113. Retrieved from <https://doi.org/10.1111/2047-3095.12105>
- \*Ramira, M. L., Instone, S., & Clark, M. J. (2016). Pediatric pain management: An evidence-based approach. *Pediatric Nursing*, 42(1), 39-50.
- \*Reavey, D. A., Haney, B. M., Atchison, L., Anderson, B., Sandritter, T., & Pallotto, E. K. (2014). Improving pain assessment in the NICU: A quality improvement project. *Advances in Neonatal Care*, 14(3), 144-153. Retrieved from <https://doi.org/10.1097/ANC.0000000000000034>
- \*Rosenberg, R. E., Klejmont, L., Gallen, M., Fuller, J., Dugan, C., Budin, W., & Olsen-Gallagher, I. (2016). Making comfort count: Using quality improvement to promote pediatric procedural pain management. *Hospital Pediatrics*, 6(6), 359-368. Retrieved from <https://doi.org/10.1542/hpeds.2015-0240>
- \*Scott, L. E., Crilly, J., Chaboyer, W., & Jessup, M. (2013). Paediatric pain assessment and management in the emergency setting: The impact of a paediatric pain bundle. *International Emergency Nursing*, 21(3), 173-179. Retrieved from <https://doi.org/10.1016/j.ienj.2012.08.004>
- \*Simons, J. M. (2002). An action research study exploring how education may enhance pain management in children. *Nurse Education Today*, 22(2), 108-117. Retrieved from <https://doi.org/10.1054/nedt.2001.0655>
- \*Simons, J., & MacDonald, L. M. (2006). Changing practice: implementing validated paediatric

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

pain assessment tools. *Journal of Child Health Care*, 10(2), 160-176. Retrieved from <https://doi.org/10.1177/1367493506062555>

Srouji, R., Ratnapalan, S., & Schneeweiss, S. (2010). Pain in children: Assessment and nonpharmacological management. *International Journal of Pediatrics*, 2010, 474838. Retrieved from <https://doi.org/10.1155/2010/474838>

Suresh, K., & Chandrashekara, S. (2012). Sample size estimation and power analysis for clinical research studies. *Journal of Human Reproductive Sciences*, 5(1), 7. Retrieved from <https://doi.org/10.4103/0974-1208.97779>

Swartz, M. (2013). Best practices in experiential learning. *The Learning and Teaching Office (LTO) Best Practices*, 36, 1-20. Retrieved from <https://www.ryerson.ca/content/dam/lt/resources/handouts/ExperientialLearningReport.pdf>

Tacconelli, E. (2010). Systematic reviews: CRD's guidance for undertaking reviews in health care. *The Lancet Infectious Diseases*, 10(4), 226. Retrieved from [https://doi.org/10.1016/S1473-3099\(10\)70065-7](https://doi.org/10.1016/S1473-3099(10)70065-7)

\*Taddio, A., Shah, V., Wang, J., Parikh, C., Smart, S., Ipp, M., ... Franck, L. S. (2015). Usability and knowledge testing of educational tools about infant vaccination pain management directed to postnatal nurses. *BMC Medical Education*, 15(1), 45. Retrieved from <https://doi.org/10.1186/s12909-015-0305-6>

Tao, J., Fore, C., & Forbes, W. (2011). Seven best face-to-face teaching practices in a blended learning environment. *Journal of Applied Learning Technology*, 1(3), 20-29.

Tetui, M., Coe, A.-B., Hurtig, A.-K., Bennett, S., Kiwanuka, S. N., George, A., & Kiracho, E. E. (2017). A participatory action research approach to strengthening health managers' capacity at district level in Eastern Uganda. *Health Research Policy and Systems*, 15(Suppl. 2), 110. Retrieved from <https://doi.org/10.1186/s12961-017-0273-x>

Thyer, B. A. (2012). *Quasi-experimental research designs*. doi:

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

10.1093/acprof:oso/9780195387384.001.0001

- Tricco, A. C., Ashoor, H. M., Cardoso, R., MacDonald, H., Cogo, E., Kastner, M., ... Straus, S. E. (2016). Sustainability of knowledge translation interventions in healthcare decision-making: A scoping review. *Implementation Science, 11*, 55. Retrieved from <https://doi.org/10.1186/s13012-016-0421-7>
- Twycross, A. (2007). What is the impact of theoretical knowledge on children's nurses' post-operative pain management practices? An exploratory study. *Nurse Education Today, 27*(7), 697-707. Retrieved from <https://doi.org/10.1016/j.nedt.2006.10.004>
- Twycross, A. (2010). Managing pain in children: where to from here? *Journal of Clinical Nursing, 19*(15-16), 2090-2099. Retrieved from <https://doi.org/10.1111/j.1365-2702.2010.03271.x>
- Twycross, A. (2013). Nurses' views about the barriers and facilitators to effective management of pediatric pain. *Pain Management Nursing, 14*(4), e164-e172. Retrieved from <https://doi.org/10.1016/j.pmn.2011.10.007>
- Vadivelu, N., Mitra, S., & Narayan, D. (2010). Recent advances in postoperative pain management. *The Yale Journal of Biology and Medicine, 83*, 11-25. Retrieved from [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844689/pdf/yjbm\\_83\\_1\\_11.pdf](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844689/pdf/yjbm_83_1_11.pdf)
- \*Vael, A., & Whitted, K. (2014). An educational intervention to improve pain assessment in preverbal children. *Pediatric Nursing, 40*(6), 301-302. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=103926585&site=ehost-live>
- \*Van Hulle, V. C., Wilkie, D. J., & Wang, E. (2011). Pediatric nurses' beliefs and pain management practices. *Western Journal of Nursing Research, 33*(6), 825-845. Retrieved from <https://doi.org/10.1177/0193945910391681>
- Vincent, C. V. H., Wilkie, D. J., & Szalacha, L. (2010). Pediatric nurses' cognitive representations of children's pain. *Journal of Pain, 11*(9), 854-863. Retrieved from

## EFFECT OF NURSE EDUCATION ON PEDIATRIC PAIN CARE

<https://doi.org/10.1016/j.jpain.2009.12.003>

Von Baeyer, C. L. (2009). Children's self-report of pain intensity: What we know, where we are headed. *Pain Research and Management*, *14*(1), 39-45. Retrieved from

<https://doi.org/10.1155/2009/259759>

Walker, S. M. (2008). Pain in children: Recent advances and ongoing challenges. *British Journal of Anaesthesia*, *101*(1), 101-110. doi: 10.1093/bja/aen097

Wludyka, P. (2012). Study designs and their outcomes. In K. Macha & J. P. McDonough (Eds.), *Epidemiology for advanced nursing practice* (pp. 81-114). USA: Jones & Barlett Learning.

Retrieved from [http://samples.jbpub.com/9780763789961/89961\\_CH03\\_Macha.pdf](http://samples.jbpub.com/9780763789961/89961_CH03_Macha.pdf)

Zeltzer, L. K., Barr, R. G., McGrath, P. A., & Schechter, N. L. (1992). Pediatric pain: interacting behavioral and physical factors. *Pediatrics*, *90*(5 Pt 2), 816-821.

Zhang, C. H., Hsu, L., Zou, B. R., Li, J. F., Wang, H. Y., & Huang, J. (2008). Effects of a pain education program on nurses' pain knowledge, attitudes and pain assessment practices in China.

*Journal of Pain and Symptom Management*, *36*(6), 616-627. Retrieved from

<https://doi.org/10.1016/j.jpainsymman.2007.12.020>

**Note:** References with asterisks (\*) are those that were included in the review and have been cited in Table 1 on a separate document titled "List of Tables Updated"