International Journal of Nursing Studies 94 (2019) 9–20

Contents lists available at ScienceDirect

International Journal of Nursing Studies

journal homepage: www.elsevier.com/ijns

Improving paediatric pain management in the emergency department: An integrative literature review

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ARTICLE INFO

Article history:
Received 26 July 2018
Received in revised form 26 February 2019
Accepted 26 February 2019

Keywords:
Child
Emergency department
Implementation
Knowledge translation
Organisational change
Paediatric
Pain
Pain management
Systems

ABSTRACT

Background: Children presenting to the emergency department continue to experience suboptimal pain management. While evidence-based pain management interventions are available to clinicians, effective and sustainable practice change is yet to be achieved. This practice gap requires a collaborative approach to knowledge translation targeting systems of care.
Objectives: The purpose of this review was to explore systems level change in the emergency department for improved paediatric pain management.
Design: Integrative review.
Data sources: CINAHL, Embase, PubMed/Medline, Dynamed, Cochrane, Scopus, Prospero and Joanna Briggs Institute were systematically searched, and clinical guidelines and reference lists scanned.
Review methods: Studies were screened and selected according to the inclusion criteria, and independently appraised for risk of bias. Integrative review methodology informed data extraction and synthesis, focused on organisational context and engagement, facilitation and implementation of practice change, key components of the pain management interventions, and evaluation.
Results: Twenty studies met the inclusion criteria: 18 uncontrolled pretest-posttest and two pseudo-randomised design. Study populations ranged from children with a specific presentation, to all presenting children. All studies adopted a multifaceted approach to organisational change, bundling various interventions including pain assessment tools and management protocols, clinician education, nurse-initiated analgesia, feedback and family engagement. Four studies used local systems analysis to inform interventions and two studies applied an implementation framework. Time to analgesia was the most commonly improved primary outcome. Parent and child sensitive outcomes were assessed in five studies. Interventions that hold the most promise for optimised pain management if embedded in the workplace include nurse-initiated analgesia and family involvement at each stage of pain management in the emergency department.
Conclusion: The way forward is to respectfully engage all stakeholders—children, parents and clinicians—to collaboratively develop evidence-based, sustainable solutions aligned with the emergency department context. Guided by an implementation framework, future research designed to creatively translate evidence into practice and facilitate change at a systems level is a priority. Key to this solution is the integration of family involvement in pain management, considering child and family sensitive outcome measures. Effectiveness of new interventions should be evaluated in the short and long term to embed sustainable practice change. Frontline nurses are well placed to lead this transformation in paediatric pain management in the emergency department.

What is already known about the topic?

- Paediatric pain management in emergency departments is suboptimal.
- There is great potential to improve the quality of paediatric pain management in emergency departments.

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https://doi.org/10.1016/j.ijnurstu.2019.02.017
0020-7489/

- There are unique challenges to knowledge translation in emergency department settings and a focused review is needed to explore what works in this context to develop recommendations for practice and future research.

What this paper adds

- Developing emergency department practice cultures where everyone is empowered to speak up, assess and take action for pain is a prerequisite for the care families expect and nurses want to provide.
- Mandating pain scoring or management protocols alone often does not translate into expected benefits; supporting nurse autonomy to initiate analgesia improves outcomes.
- We argue for collaborative approaches to knowledge translation for paediatric pain management in the emergency department with greater engagement of clinicians and families at every stage of implementation.

1. Introduction

Waiting in pain in the emergency department is emotionally and physically harmful. Every child has the right to recognition, assessment and management of pain (WHO, 2012). Yet children are particularly vulnerable to inadequate pain control because of developmental and communicative barriers; they must rely on adults to interpret their pain and act as advocates. Clinicians have risen to the challenge of developing age-appropriate paediatric pain management tools and interventions to support effective pain care for children in any setting. However, pain management for children in the emergency department continues to be suboptimal (Herd et al., 2009; Taylor et al., 2013; Yackey and Rominger, 2018). Children risk having long delays to analgesia in the emergency department, particularly those younger than three years old or patients triaged as low acuity (Yackey and Rominger, 2018).

Failure to effectively manage children's pain in the emergency department has unintended but harmful consequences. In the short term, untreated acute pain heightens pain perception, anxiety and fear, undermining the relationship of trust between child, family and clinician (Ely and Tsao, 2008). Pain and anxiety can prevent accurate physical assessment and delay necessary procedures or interventions, potentially exacerbating the child's condition and length of stay in the emergency department (Brent et al., 2009). Acute pain in childhood can also have long term implications across the lifespan, contributing to the development of chronic and complex pain problems (Schug et al., 2015; Walker, 2017) and healthcare phobias and avoidance (Ely and Tsao, 2008; Pasero, 2003; Rupp and Delaney, 2004).

The problem of suboptimal paediatric pain management is not new. Despite more than two decades of literature urging clinicians to adopt evidence-based assessment tools and interventions, progress has been slow in acute paediatric settings (Gagnon et al., 2016; Scott-Findlay and Estabrooks, 2006; Twycross et al., 2013; Yamada and Hutchinson, 2014). Foster (2013) argues this practice gap reflects a lack of knowledge translation and our limited understanding of how this evidence serves nurses in the moment of practice. A key challenge has been moving the field beyond a focus on individual nurse knowledge deficits as the root of the problem, to support change at the organisational and cultural levels (Kavanagh et al., 2008; Scott-Findlay and Estabrooks, 2006). Pain management initiatives have been focused on modifying narrow aspects of clinician behaviour rather than attending to the social process of knowledge translation. We see evidence of this when well-intentioned pain protocols that do not respond to the needs of frontline nurses succumb to work-arounds, as staff attempt to simplify the process to accomplish the desired outcome (von Baeyer and Pasero, 2017).

The most recent systematic review of interventions to improve pain management in adult and paediatric emergency departments found insufficient evidence to recommend widespread adoption of any single or multi-faceted intervention (Sampson et al., 2014). Given the high risk of bias and significant variation in the 43 studies reviewed, the authors argued for more robust and theoretically informed research designs, with a greater focus on patient-oriented outcomes (Sampson et al., 2014). Importantly they argue we need to understand how and why interventions work to improve pain management in the emergency department, and under what organisational conditions. These findings are reflected in Australian recommendations promoting a multi-faceted, organisational approach to pain management in the emergency department (Shaban et al., 2012).

A comprehensive systematic review of knowledge translation in the paediatric pain management literature points to the lack of rigorous evaluation in settings other than the emergency department (Gagnon et al., 2016). Echoing Sampson et al. (2014), conclusions were limited by the high risk of bias of the 98 studies reviewed, lack of patient-related outcomes and minimal evaluation of program sustainability. Gagnon et al. (2016) advocate for improved study designs with a focus on systems level paediatric pain management interventions, evaluation of patient outcomes and sufficient follow-up periods to ensure program sustainability. Although this review was intentionally broad, there are clear gaps in recommendations for knowledge translation in paediatric pain management in the emergency department context.

Organisational solutions to complex problems require systems thinking. Effective pain management occurs across a continuum of care, yet pain initiatives tend to focus on the initial management of acute pain rather than the entire episode of care. Commonly measured outcomes focus on emergency department provider behaviour as a proxy for patient experience and outcomes, such as time to analgesia, documentation of pain assessment and provision of analgesia (Gagnon et al., 2016; Stang et al., 2014). From an organisational perspective, systems of care that improve parental and family engagement with evidence-based pain management strategies are needed. Family involvement is a central tenet of quality paediatric healthcare. We know that families want to be involved in their child's care and participate in decision-making (Brown et al., 2008; Byczkowski et al., 2015; Krauss et al., 2016). Yet emergency department clinicians often make decisions about paediatric pain management without involving the parent and child (Curran et al., 2012).

Given the unique challenges of paediatric pain in the emergency department a focused review of organisational approaches to embed safe and effective pain management is needed. To support this area of practice we have undertaken an integrative literature review to establish the status quo in paediatric pain management in the emergency department and set the research agenda for clinicians and families to inform practice change.

1.1. Objectives

This integrative review sought to bring together available evidence on systems or organisational change in the emergency department for improved paediatric pain management. The aims of the review were to:

- Explore the literature to identify paediatric pain management interventions implemented at a work unit level.
- Establish which interventions were effective and sustainable in improving the quality of pain management.

- Identify what works in the emergency department context to develop recommendations for clinical practice and future research.

2. Methods

2.1. Design

The phenomena of interest explored in this review was acute pain management of children presenting to the emergency department. The review was guided by Whittemore and Knafl's (2005) integrative methodology, involving a synthesis of studies which are relevant to this area of practice irrespective of study design (Hopia et al., 2016). This approach enabled us to draw on all of the available, relevant research to progress a better understanding of the evidence to improve paediatric pain management in the emergency department (Whittemore and Knafl, 2005).

2.2. Inclusion criteria

Selection of studies was guided by the PICO framework (Population, Intervention, Comparison and Outcome) (Schardt et al., 2007). The population was defined as children presenting to a paediatric or mixed emergency department with any acute condition. Studies were considered if the population was deemed to be paediatric; a strict age range was not applied. In the spirit of an integrative review this enabled inclusion of several significant studies which may have otherwise been excluded. Interventions of interest were those that aimed to improve emergency department paediatric pain management at a systems or organisational level. Because of the nature of research in this field a concurrent comparison group was not specified. Outcomes of interest specifically related to pain management including: time to analgesia, provision of analgesia, reassessment of pain, repeat analgesia, reduction in pain score, child/parent satisfaction, parental knowledge and clinician knowledge. There were no date limitations specified.

Studies were excluded if they related to a strictly adult population, compared or measured effectiveness of specific medications, focused on a specific chronic illness (e.g., sickle cell disease), or investigated procedure-related pain. There was no restriction on study design.

2.3. Search strategy

A comprehensive literature search was conducted using MeSH and textual terms related to key search words: child* OR paediatric OR pediatric, AND "emergency" OR "emergency department" OR "emergency room" OR "emergency ward," AND pain AND "pain management." Electronic databases were searched including CINAHL, Embase, PubMed, Dynamed, Cochrane, Scopus, Prospero and Joanna Briggs Institute. Grey literature, clinical guidelines and reference lists were also scanned. A total of 3184 studies were initially identified by electronic search, duplicates removed (see Supplementary Table 1 for results by database); and titles and abstracts screened, yielding 53 studies for full text assessment. Twenty studies which adhered to the inclusion criteria were identified for review (Fig. 1). Search alerts were embedded in the primary databases to identify any relevant publications released after the initial search was executed.

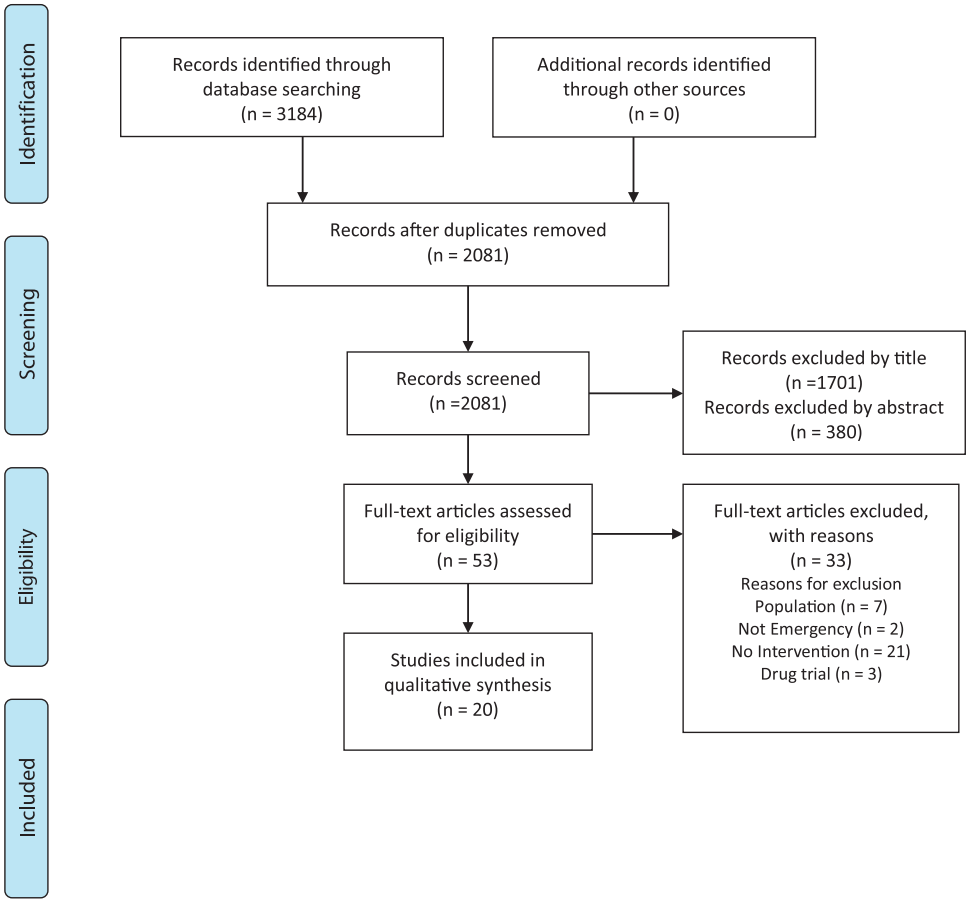

Fig. 1. PRISMA 2009 Flow Diagram (Moher et al., 2009).

2.4. Quality appraisal

Quality assessment of the literature was undertaken independently by two authors using a modified risk of bias assessment tool (Sampson et al., 2014) (Table 1).

Comparability of the pre-post cohorts was difficult to assess in 10 studies (Boyd and Stuart, 2005; Eisen and Amiel, 2007; Habich and Letizia, 2015; Jadav et al., 2009; Le May et al., 2009; LeMay et al., 2010; Newstead et al., 2013; Porter et al., 2015; Ramira et al., 2016; Taylor et al., 2013) because baseline characteristics were inadequately reported, inequality in group diagnoses, age or causation of pain and/or the small numbers of participants recruited. Ten studies reported consecutive participant selection (Boyd and Stuart, 2005; Hawkes et al., 2008; Iyer et al., 2011; Jadav et al., 2009; Kaplan et al., 2008; Porter et al., 2015; Ramira et al., 2016; Scott et al., 2013; Somers et al., 2001; Williams et al., 2012) while in the remaining studies the selection process was unclear, or numbers too small to be representative of the population. Two studies ceased recruitment during the evening and on weekends (Corwin et al., 2012; Taylor et al., 2013), leading to potential selection bias. The studies utilising a pseudo-randomised design (Tanabe et al., 2002) employed sequential allocation rather than randomised allocation.

The method of data collection was considered in each of the studies. Eleven studies utilised retrospective data collection (Habich and Letizia, 2015; Hawkes et al., 2008; Iyer et al., 2011; Jadav et al., 2009; Kaplan et al., 2008; Newstead et al., 2013; Ramira et al., 2016; Santervas et al., 2010; Scott et al., 2013; Somers et al., 2001; Williams et al., 2012), seven studies collected data prospectively (Boyd and Stuart, 2005; Brent et al., 2009; Corwin et al., 2012; Le May et al., 2009; LeMay et al., 2010; Tanabe et al., 2002; Taylor et al., 2013), and two studies used a combination (Eisen and Amiel, 2007; Porter et al., 2015). Authors acknowledged that retrospective data collection has the potential to undermine validity, given the reliance on the accuracy and completeness of patient charts. However, there were no reports of missing data (Jadav et al., 2009; Santervas et al., 2010). There was considerable variability across studies in the time between pre and post intervention phases, ranging from months to years. Two studies reported blinding staff or participants (Corwin et al., 2012; Taylor et al., 2013). Despite the dynamic emergency department environment only five studies identified potential contamination bias (Iyer et al., 2011; Le May et al., 2009; Scott et al., 2013; Tanabe et al., 2002; Taylor et al., 2013).

Overall, studies were assessed as having a high risk of bias, particularly regarding comparability of the pre-post cohorts, participant selection, data collection methods and blinding. Nonetheless, this literature is important because it describes clinician-led projects aimed at improving paediatric pain management practice.

2.5. Data analysis and synthesis

Studies were selected according to the inclusion and exclusion criteria, and the following data extracted: study characteristics, aims, study design, population, age, number of participants, single or multi-site, mixed or paediatric emergency department, nature of the intervention and outcome measures. To guide our analysis we used the framework suggested by Whittemore and Knafl (2005) to systematically order, categorise and summarise data from the included studies. Extracted data were compared item by item and tabulated to categorise pain management interventions and study outcomes. Narrative synthesis guided identification and comparison of interventions and outcomes (Ryan and Hill, 2016). As this review was interested in exploring paediatric pain management in emergency department from a systems perspective studies were also examined in regard to organisational context and engagement, facilitation and implementation of practice change, key components of the pain management interventions, and evaluation (Gagnon et al., 2016; Kitson et al., 1998).

3. Results

3.1. Characteristics of included studies

A total of 20 studies met the inclusion criteria for the integrative review (Table 2).

Of these four originated in Australia (Boyd and Stuart, 2005; Scott et al., 2013; Taylor et al., 2013; Williams et al., 2012), three from Canada (Le May et al., 2009; LeMay et al., 2010; Porter et al., 2015), five from the United Kingdom (Eisen and Amiel, 2007; Hawkes et al., 2008; Jadav et al., 2009; Newstead et al., 2013; Somers et al., 2001), seven from the USA (Brent et al., 2009; Corwin et al., 2012; Habich and Letizia, 2015; Iyer et al., 2011; Kaplan et al., 2008; Ramira et al., 2016; Tanabe et al., 2002) and one from Spain (Santervas et al., 2010). All of the studies were single centre, 50% conducted in a paediatric emergency department and 50% in a mixed adult/paediatric emergency department. Sixteen studies utilised an uncontrolled pretest-postest design, one study applied a prospective post-test, one study applied a retrospective post-test and two studies applied pseudo-randomised controlled designs. Reported sample sizes ranged from 52 to 1,200, with three studies including less than 100 participants (Habich and Letizia, 2015; Newstead et al., 2013; Tanabe et al., 2002). Sample size calculations were reported in six studies (Corwin et al., 2012; Kaplan et al., 2008; Scott et al., 2013; Tanabe et al., 2002; Taylor et al., 2013; Williams et al., 2012).

Study populations ranged from children with a specific injury or illness, to all children presenting to the emergency department irrespective of reason for presentation or diagnosis. All studies nominated the study population as paediatric, yet age ranges differed significantly. Two US studies were conducted in paediatric emergency departments with an age range extending to 20 and 25 years respectively (Corwin et al., 2012; Kaplan et al., 2008). These studies were included based on contribution to the literature and the paucity of evidence in this area. Two studies stated the population was paediatric but did not report an age range (Brent et al., 2009; Iyer et al., 2011). The mean age range across studies was three months to 16.9 years.

3.2. Approaches to practice change

Each study was reviewed to identify the rationale and approach to practice change. All studies shared the common goal of improving pain management in response to recognised deficits in pain management practice within their own departments. Practice change aimed to change clinician behaviour through the introduction of evidence-based protocols or policy (Boyd and Stuart, 2005; Brent et al., 2009; Corwin et al., 2012; Eisen and Amiel, 2007; Hawkes et al., 2008; Iyer et al., 2011; Jadav et al., 2009; Kaplan et al., 2008; Porter et al., 2015; Santervas et al., 2010; Scott et al., 2013; Somers et al., 2001; Tanabe et al., 2002; Taylor et al., 2013; Williams et al., 2012) or improve nurses' knowledge of pain management through an education program (Habich and Letitia, 2015; Le May et al., 2009; Ramira et al., 2016). Two studies endeavoured to influence pain management outcomes by engaging parents in pain scoring (Newstead et al., 2013) and providing parental education (LeMay et al., 2010). Interventions were developed based on clinical expertise, evidence-based pain management tools, or a review of the literature. Only two studies

Table 1
Risk of Bias Assessment (adopted from Sampson et al., 2014).

Author	Comparability *Were the pre-post-test cohorts comparable?*	Period of Assessment *Were control and intervention groups concurrent?*	Representative *Was recruitment random or consecutive?*	Blinding *Was there any evidence of blinding of staff or patients?*	Contamination *Did authors discuss any concurrent interventions that may contaminate results?*	Reporting Bias *Were all main outcomes were reported?*	Prospective *Was data collection prospective or retrospective?*
Boyd and Stuart, 2005	NR	N	Y	NR	NR	N	P/P/P
Brent et al., 2009	NA	N	NR	NR	NR	N	P
Corwin et al., 2012	Y	N	N	Y	NR	N	P/P
Eisen and Amiel, 2007	NR	N	NR	NR	NR	N	R/P
Habich and Letizia, 2015	NA	N	N	NR	NR	N	R
Hawkes et al., 2008	Y	N	Y	NR	NR	N	R/R
Iyer et al., 2011	Y	N	Y	NR	Y	N	R/R
Jadav et al., 2009	NR	N	Y	N	NR	N	R/R
Kaplan et al., 2008	Y	N	Y	Y	NR	N	R/R
Le May et al., 2009	N	N	Y	NR	Y	N	P
LeMay et al., 2010	N	N	Y	N	N	N	P
Newstead et al., 2013	N	N	N	NR	NR	N	R/R
Porter et al., 2015	N	N	Y	NR	NR	N	R/P
Ramira et al., 2016	NR	N	Y	NR	NR	N	R/R
Santervas et al., 2010	Y	N	Y	NR	Y	N	R/R
Scott et al., 2013	Y	N	Y	NR	NR	N	R/R
Somers et al., 2001	Y	N	Y	NR	NR	N	R/R
Tanabe et al., 2002	Y	Y	Y	N	Y	N	P
Taylor et al., 2013	N	N	N	Y	Y	N	P/P
Williams et al., 2012	Y	N	Y	NR	NR	N	R/R

KEY–Y – Yes, **N** – No, **NR** – Not Reported, **P** – Prospective, **R** – Retrospective,**NA** – Not Applicable.

reported using state-wide or national pain guidelines (Habich and Letizia, 2015; Kaplan et al., 2008).

Organisational engagement was evident in either informal or formal multidisciplinary consultation (including nurses, doctors and allied health professionals), to inform analysis of current practice and intervention design. Some research aimed to improve operational and clinical efficiency in the emergency department and practice change was motivated by increased waiting times and time to analgesia attributed to a rapid growth in presentations. For example the goal of one study was reducing the mean time to analgesia by introduction of clinical pathways (Brent et al., 2009). Participation in an *emergency department process improvement collaborative* comprised of doctors, nurses and administration staff guided development of new processes (Brent et al., 2009). This

Table 2
Study Characteristics.

Author Country	Year	Study design	Aims	Setting Sample	Age (Years)
Boyd & Stuart Australia	2005	Pre-Post Test	To ascertain if changes in triage pain assessment and nurse initiated analgesia can have an impact on the rates of analgesia provision and times to analgesia provision for children presenting to the emergency department with peripheral limb injury	Adult and paediatric limb injuries n = 151 vs 140 vs 126	0 – 16
Brent et al. USA	2009	Post Test	To reduce the time to initial administration of pain medications for suspected extremity fractures from 1 hour 42 minutes to 30 minutes	Paediatric ED Fractures (extremity) n (fractures) not reported	Paediatric
Corwin et al. USA	2012	Pre-Post Test	To measure the impact of a structured intervention (pain policy) on pain management in a paediatric emergency department	Paediatric ED All presentations n = 102 vs 109	0 - 25
Eisen & Amiel UK	2007	Pre-Post Test	To improve pain management in children attending the emergency department utilising a pain management protocol	Adult and paediatric ED Painful condition n = 115 vs 116	4 - 16
Habich & Letizia USA	2015	Post Test	To develop, implement, and evaluate a paediatric pain education program and pain assessment protocol to improve nurses' knowledge and standardize care in a community hospital emergency department.	Adult and paediatric ED All presentations n = 60	0 - 16
Hawkes et al. UK	2008	Pre-Post Test	To describe the provision of analgesia and analyse and modify the pain management protocol to improve time to provision and time to analgesia.	Adult and paediatric ED All presentations excluding respiratory symptoms n = 95 vs 145	1 - 16
Iyer et al. USA	2011	Pre-Post Test	To reduce delays in intravenous opioid delivery for children presenting to the ED with long bone extremity fractures with the introduction of an orthopaedic evaluation process.	Paediatric ED Fractures (long bone) n = 387 vs 615	Paediatric
Jadav et al. UK	2009	Pre-Post Test	To improve the frequency and type of analgesia for children with a painful condition with the introduction of mandatory pain scoring at triage.	Paediatric ED Fractures (long bone), burns n = 187 vs 163	$\leq$ 11
Kaplan et al. USA	2008	Pre-Post Test	To examine the impact of incorporating the Wong Baker Faces Pain Scale into the emergency medical record on the rate of physician pain documentation and analgesia administration in a pediatric emergency department. To describe any effect the intervention has on timeliness of analgesia administration.	Paediatric ED All presentations n = 462 vs 372	3 - 20
LeMay et al. Canada	2009	Pre-Post Test	To verify if tailored educational interventions would improve emergency nurses' knowledge of pain management and quality of nurses' pain management practices	Paediatric ED Burn, fracture, laceration, sprain, acute abdominal pain n = 150 vs 104 vs 119	Paediatric
LeMay et al. Canada	2010	Pseudo Randomised Trial	To assess the efficacy of a parental educational intervention on children's pain intensity and experience of pain at 24 hours post discharge from the emergency department. To assess parental beliefs about pain.	Paediatric ED Musculoskeletal injury, burn, laceration, abdominal pain n = 98 vs 97	4 - 15
Newstead et al. UK	2013	Pre-Post Test	To improve prompt analgesia provision and empower the patient/parent/guardian by the introduction of the "pain passport". To encourage re-evaluation of children's pain by recording multiple pain scores.	Adult and paediatric ED Long bone fracture n = 26 vs 26	5 - 15
Porter et al. Canada	2015	Pre-Post Test	To measure the effectiveness of a set of interventions in improving the rate and timeliness of analgesic medication administration, as well as appropriate backslab immobilization in a pediatric emergency department.	Paediatric ED Supracondylar fracture n = 160 vs 24	0 - 12
Ramira et al. USA	2016	Pre-Post Test	To improve documentation of pain assessment, decrease time to analgesia and determine the effect of the intervention in reducing children's pain at discharge.	Adult and paediatric ED All presentations n = 600 vs 600	3m - 6
Santervas et al. Spain	2010	Pre-Post Test	To evaluate the impact on the management of acute pain in a paediatric emergency department following the development of an educational program.	Paediatric ED Abdominal pain, headache, chest pain n = 150 vs 150	3 - 18
Scott et al. Australia	2013	Pre-Post Test	To evaluate the impact of a paediatric pain bundle pain assessment and management of children with # forearm who presented to an emergency department.	Adult and paediatric ED Fractures (forearm) n = 126 vs 116	0 - 16
Somers et al. UK	2001	Pre-Post Test	To improve the time taken for children arriving to the accident and emergency department in pain to receive analgesia.	Adult and paediatric ED Painful injuries n = 129 vs 133	< 16

Table 2 (*Continued*)

Author Country	Year	Study design	Aims	Setting Sample	Age (Years)
Tanabe et al. USA	2002	Pseudo Randomised Trial	To determine the effectiveness of nursing interventions in decreasing pain for children with minor musculoskeletal trauma and moderate pain and to examine patient satisfaction.	Adult and paediatric ED Musculoskeletal injury n = 76	5 - 17
Taylor et al. Australia	2013	Pre-Post Test	To evaluate the impact of a nurse initiated analgesia pathway intervention for paediatric patients in the emergency department.	Adult and paediatric ED Pain score > = 4 Triage score 3 - 5 n = 51 vs 51	5 - 17
Williams et al. Australia	2012	Pre-Post Test	To improve documentation of pain score at triage, time to analgesia, knowledge of pain management (nursing and medical) and identify barriers to pain management of abdominal pain.	Paediatric ED Abdominal pain n = 80 vs 80	0 - 16

collaborative approach was replicated in other settings in the form of a *multidisciplinary committee* of doctors, nurses, therapeutic play and education specialist to inform guideline development (Corwin et al., 2012); *informal discussion with nurses and physicians* to develop an intervention approved by the quality improvement committee (Hawkes et al., 2008); and *formation of an expert panel* comprised of advanced practice nurses, doctors and a pharmacist to inform guideline development (Williams et al., 2012).

Explicit application of knowledge translation principles was absent in most studies with two exceptions. A plan-do-study-act methodology guided the development of a complex orthopaedic pain management intervention (Iyer et al., 2011), while the Iowa Model of Evidence Based Practice informed the development of a pain education strategy for emergency department nurses (Ramira et al., 2016).

3.3. Facilitating and implementing effective pain care

3.3.1. Adopting tools

Each study adopted a multi-faceted approach to pain management, bundling different combinations of interventions into a process which influenced care delivery (Table 3). Most interventions were aimed at providing a common language for clinicians to identify and respond to a patient's pain with appropriate analgesia. Pain assessment at triage was a key focus, enacted by the integration of pain *scoring at triage or a pain management protocol* (Boyd and Stuart, 2005; Corwin et al., 2012; Eisen and Amiel, 2007; Hawkes et al., 2008; Iyer et al., 2011; Jadav et al., 2009; Porter et al., 2015; Scott et al., 2013; Williams et al., 2012). Five studies trialled protocols which *guided pain management throughout the continuum of care* (Brent et al., 2009; Corwin et al., 2012; Iyer et al., 2011; Taylor et al., 2013; Williams et al., 2012), while other protocols focused on *improving nursing knowledge, education and skills* (Habich and Letizia, 2015; LeMay et al., 2009; Scott et al., 2013; Somers et al., 2001), *defining nursing roles* (Hawkes et al., 2008), *mandatory pain scoring* (Corwin et al., 2012; Jadav et al., 2009; Santervas et al., 2010) and *physician-targeted education* (Kaplan et al., 2008). The least commonly explored intervention was distraction which demonstrated favourable outcomes in a pseudo-randomised trial compared to ibuprofen and splinting (Tanabe et al., 2002). Other studies integrated distraction within pain management protocols as an adjunct to analgesia (Taylor et al., 2013; Williams et al., 2012).

3.3.2. Nurse-initiated analgesia

Five studies tested the effectiveness of nurse-initiated analgesia, specifically non-opioid oral analgesics. Four of these reported a clinically significant reduction in time to analgesia from 138 to 47 min, 102 to 45 min, 54 to 7 min and 58 to 23 min respectively (Boyd and Stuart, 2005; Brent et al., 2009; Hawkes et al., 2008; Taylor et al., 2013). Nurse-initiated analgesia within a broader *pain management pathway* (Taylor et al., 2013), guided the emergency department nurse through each stage of pain management from assessment to evaluation, leading to a significant improvement in time to analgesia, provision of analgesia and parental satisfaction. The provision of nurse-initiated simple and opioid analgesia was sometimes restricted by local policy or legislation, limiting evaluation of the full potential of this intervention (Corwin et al., 2012; Somers et al., 2001).

3.3.3. Education and communication

Pain management education improved documentation of pain scores, although this outcome did not always translate into increased provision of analgesia (Boyd and Stuart, 2005; Jadav et al., 2009; Kaplan et al., 2008; Le May et al., 2009; Scott et al., 2013; Williams et al., 2012). Conversely, several studies reported improvement in both documentation of pain scores and provision of analgesia when education was a component of a broader pain management protocol (Boyd and Stuart, 2005; Corwin et al., 2012; Eisen and Amiel, 2007; Santervas et al., 2010; Taylor et al., 2013). It is important to note that provision of analgesia was not an outcome measured across all studies.

Clinical education of nursing and/or medical staff was integrated within the broader intervention. It was difficult to evaluate how comprehensive education was – single short sessions are unlikely to have large effects. Two studies found improvements in both pain score documentation and time to analgesia after comprehensive pain management nursing education programs (Le May et al., 2009; Ramira et al., 2016). Le May et al. (2009) was unable to demonstrate an improvement in the provision of analgesia, an outcome which Ramira et al. (2016) did not measure. Seven studies tailored *education to nurses* (Boyd and Stuart, 2005; Brent et al., 2009; Habich and Letizia, 2015; Le May et al., 2009; Ramira et al., 2016; Scott et al., 2013; Taylor et al., 2013), one study provided *education to medical officers* (Kaplan et al., 2008), and five studies provided *education to both nurses and doctors* (Corwin et al., 2012; Hawkes et al., 2008; Jadav et al., 2009; Porter et al., 2015; Somers et al., 2001; Williams et al., 2012).

A variety of communication methods are described within the literature aimed at both families and clinicians. *Strategies focusing on families included brochures and posters* (Corwin et al., 2012; Hawkes et al., 2008). *Visual pain management prompts* were frequently used as a reminders for clinicians, including guidelines, pain scoring tools and posters (Hawkes et al., 2008; Jadav et al., 2009; Santervas et al., 2010; Somers et al., 2001; Ramira et al., 2016; Taylor et al., 2013; Williams et al., 2012). Other strategies

Table 3
Study Interventions.

Author	Multi-faceted Intervention	Pain Score documentation	Education	Nurse initiated analgesia	Distraction	Audit Feedback Reminders	Parent/Child Engagement	Systems Analysis
Boyd and Stuart, 2005	x	x	x	x				
Brent et al., 2009	x	x	x	x				x
Corwin et al., 2012	x	x	x			x	x	x
Eisen and Amiel, 2007	x	x	x					
Habich and Letizia, 2015	x	x	x					x
Hawkes et al., 2008	x	x	x	x		x		
Iyer et al., 2011	x	x		x		x		x
Jadav et al., 2009	x	x	x			x		
Kaplan et al., 2008	x	x	x					
Le May et al., 2009	x	x	x					
LeMay et al., 2010	x	x	x				x	
Newstead et al., 2013	x	x	x				x	
Porter et al., 2015	x	x	x					
Ramira et al., 2016	x	x	x					
Santervas et al., 2010	x	x	x					
Scott et al., 2013	x	x	x			x		
Somers et al., 2001	x	x	x					
Tanabe et al., 2002	x	x			x			
Taylor et al., 2013	x	x	x	x	x	x		
Williams et al., 2012	x	x	x		x	x		

included *updated graphic reports of time to analgesia data* (Brent et al., 2009) and *pictorial representation of a pain scoring tool into the electronic medical record* to visually prompt physicians to assess pain (Kaplan et al., 2008).

3.3.4. Family involvement

A minority of studies explored parental and family education (Corwin et al., 2012; LeMay et al., 2010; Newstead et al., 2013). LeMay et al. (2010) implemented a *passive parental educational intervention*, providing parents randomised to intervention with a pain management booklet and bookmark. This intervention did not reduce pain or influence the pain beliefs of parents, suggesting that more active engagement of parents is needed (LeMay et al., 2010). Another study tested a "pain passport" which actively engaged the parent and child in a pain management discussion with nurses, encouraging children and parents to monitor and track the child's pain score during their stay in the emergency department (Newstead et al., 2013). Time to analgesia was significantly improved with 69% of post-test participants receiving analgesia within 20 min in comparison to 37% in the pre-test phase. Whether this improvement can be attributed to the intervention is unclear given the sample size of 26 children. The importance of these studies is that they represent an effort towards family involvement (Byczkowski et al., 2015). This philosophy is not evident in the other studies included in this review, despite pain management being a high priority for parents.

3.4. Evaluating outcomes

The most commonly evaluated study outcomes reported were: time to analgesia, documentation of pain score, and provision of analgesia (Table 4).

3.4.1. Time to analgesia

Significant reductions in time to analgesia ranged from 7 to 57 min (Boyd and Stuart, 2005; Brent et al., 2009; Corwin et al., 2012; Eisen and Amiel, 2007; Iyer et al., 2011; Newstead et al., 2013; Porter et al., 2015; Ramira et al., 2016; Somers et al., 2001; Taylor et al., 2013). Children with obvious injuries such as clinically evident fractures received more timely analgesia (Hawkes et al., 2008; Iyer et al., 2011), whereas other groups of children (such as those under four years of age) did not achieve a reduction in time to analgesia (Somers et al., 2001).

3.4.2. Pain score documentation and provision of analgesia

Three studies reported documentation of pain score in isolation (Porter et al., 2015; Ramira et al., 2016; Williams et al., 2012), whereas 12 studies reported pain score documentation in relation to analgesia provision (Boyd and Stuart, 2005; Corwin et al., 2012; Eisen and Amiel, 2007; Habich and Letizia, 2015; Hawkes et al., 2008; Jadav et al., 2009; Kaplan et al., 2008; Le May et al., 2009; Newstead et al., 2013; Santervas et al., 2010; Scott et al., 2013; Taylor et al., 2013). While most of these studies demonstrated a significant improvement in documentation of pain score, this did not always result in improved analgesia (Boyd and Stuart, 2005; Hawkes et al., 2008; Jadav et al., 2009; Kaplan et al., 2008; Le May et al., 2009; Santervas et al., 2010; Williams et al., 2012).

3.4.3. Pain reassessment

Reassessment of pain after treatment is essential to determine the child's response and titrate medication, a basic premise of effective pain management (Ramira et al., 2016). With the exception of Scott et al. (2013), several studies identified an improvement in reassessment of pain after initial administration of analgesia (Corwin et al., 2012; Newstead et al., 2013; Ramira et al., 2016; Santervas et al., 2010).

3.4.4. Sustainability

Sustainability of practice change is an important consideration as new practices are often well supported during the initial implementation phase, while long term outcomes are overlooked (Kitson et al., 1998). This aspect of implementation is key to embedding practice change in the long term (Gagnon et al., 2016). Two studies reported a sustained improvement in time to

Table 4
Primary Study Outcomes.

Author	Time to Analgesia	Provision of Analgesia	Pain Score Documentation	Pain Reassessment	Repeat Analgesia	Pain Score Reduction	Child/parent Satisfaction	Parental knowledge	Clinician Knowledge
Boyd and Stuart, 2005	x	x	x						
Brent et al., 2009	x								
Corwin et al., 2012	x	x	x	x		x	x		
Eisen and Amiel, 2007	x	x	x						
Habich and Letizia, 2015	x	x	x	x					x
Hawkes et al., 2008	x	x	x						
Iyer et al., 2011	x						x		
Jadav et al., 2009		x	x						
Kaplan et al., 2008	x	x	x						
Le May et al., 2009		x	x						x
LeMay et al., 2010								x	
Newstead et al., 2013	x	x	x	x					
Porter et al., 2015	x								
Ramira et al., 2016	x		x			x			x
Santervas et al., 2010		x	x	x	x				
Scott et al., 2013	x	x	x	x					
Somers et al., 2001	x								
Tanabe et al., 2002						x	x	x	
Taylor et al., 2013	x	x	x				x		
Williams et al., 2012	x		x	x					x

analgesia over several years (Brent et al., 2009; Iyer et al., 2011). Iyer et al. (2011) also reported an improvement in parent satisfaction over a two year period.

4. Discussion

This integrative review sought to bring together the available evidence on systems or organisational change in the emergency department for improved paediatric pain management. Twenty studies were included that sought to improve paediatric pain management from an organisational perspective. Findings of this review highlight a significant gap in the evidence on systems change in the emergency department to create the conditions for safe and effective paediatric pain management. Interventions remain focused on change at the individual level. Even when attempting to introduce change at a systems level, interventions tend to focus on individual behavioural change rather than context and culture (Brent et al., 2009; Ramira et al., 2016). We argue that more education programs targeting improved knowledge and attitudes as the primary outcome will not be highly contributory to advancing practice. Very few studies adopted an implementation science approach to support the social process of knowledge translation (Brent et al., 2009; Ramira et al., 2016).

Time to analgesia was the most common primary outcome improved, supported by a departmental systems analysis (Brent et al., 2009; Corwin et al., 2012; Iyer et al., 2011; Ramira et al., 2016). Yet this process measure may not capture the quality or effectiveness of pain management (Stang et al., 2014). Although clinical targets of analgesia within 30 to 45 min of presentation are widely accepted, we question if 30 min is an appropriate benchmark for children waiting in pain. Furthermore, while effectiveness of pain management must be evaluated over the entire emergency department stay, current research focuses on assessing pain on presentation and measuring time to analgesia at a single point rather than across the continuum of care. Very few studies explored reassessment of pain or pain score on discharge from emergency department.

Little is known about the impact of delayed analgesia on the child and family experience, confidence in emergency department staff, and family adherence to recommendations. Outcome measures were very clinician-focused, failing to explore the effect of interventions on the child and family (Stang et al., 2014). For example, pain score documentation was frequently reported as a primary clinical outcome. But improvement in documentation did not consistently translate into timely analgesia or better pain management outcomes (Boyd and Stuart, 2005; Hawkes et al., 2008; Jadav et al., 2009; Kaplan et al., 2008; Le May et al., 2009; Santervas et al., 2010; Williams et al., 2012). There are gaps in evaluating the clinical consequences of suboptimal pain management, such as delayed management and diagnosis. Other consequences of poor pain management require further exploration such as length of stay, how the family and child were able to manage pain after discharge, and pain-related representations to the emergency department.

Few conclusions can be drawn about the sustainability of pain interventions reviewed. This is an outcome that should be carefully considered in future research to assess if improvements are sustained over time, or if gains fall away after a program finishes (Gagnon et al., 2016). Ongoing evaluation can identify and respond

to barriers to implementation and maintain clinician focus on effective pain management through feedback.

An important finding of this review was the limited role of the family and child in pain management interventions. Parents expect to be consulted about their child's pain and that pain be effectively managed in the emergency department (Byczkowski et al., 2015). The literature asserts parents and children are members of the emergency department pain management team (Ruest and Anderson, 2016) and that collaboration between parents, children and health professionals can be mutually beneficial (Brown et al., 2008). Yet the family and child were rarely consulted or engaged in the pain management process in the studies reviewed. Family involvement is a central tenet in paediatric practice and there is potential to improve emergency department pain management practice through mutual collaboration between the patient, family and clinician (Brown et al., 2008; Byczkowski et al., 2015; Krauss et al., 2016).

4.1. Nursing practice implications

There are key implications for nursing practice and nurses as the primary pain managers in the emergency department. Nurse-initiated analgesia is an effective pain management strategy which needs to be developed to its full potential. This review found that nurse-initiated analgesia improves provision and time to analgesia, and reassessment of pain. However, nurses are often restricted in the initiation of opioids, which delays management of moderate to severe pain. This is contrary to the evidence that administration of opioids by nurses is a safe practice (Fry and Holdgate, 2002). Pain management and nursing practice has the potential to be improved by policy which recognises emergency department nurses as the primary managers of pain and supports this role with nurse-initiated opioid analgesia.

Nursing engagement and leadership is key to pain assessment and management, yet a top-down approach to change prevails in the literature where nurses are subjects rather than participants of practice change (Foster, 2013). In the emergency department setting pain assessment must begin at triage where the first clinician a child and family will encounter is a registered nurse (Ramira et al., 2016). The nurse accompanies the child and family through every step of the continuum of care, engaging with and advocating for the family. Nurses are therefore critical stakeholders in pain management practice and need to work in partnership with children and their families to achieve the common goal of effective, timely analgesia (Foster, 2013). Nurses have an opportunity, indeed a responsibility, to lead the way in pain management and become the clinical change champions this area of practice so greatly needs, creating new solutions for the emergency department context. Given knowledge translation is a social process, it makes sense to build pain management solutions that value nursing knowledge, child and family experience, and recognise that engagement of our nursing clinical leaders will facilitate more effective adoption of evidence at the point of care.

4.2. Research implications

Based on this integrative review we offer key recommendations for future research. It is clear that this evidence to practice gap requires a collaborative approach to knowledge translation: one that targets systems of care, rather than individual clinician behaviour. There is a pressing need for research to develop knowledge translation strategies for paediatric pain that work in the emergency department context. Key to this solution is to engage families to be involved in their child's pain management. A greater emphasis must also be placed on improving the child and family's experience through more sensitive outcome measures such as response to analgesia, pain score on discharge, child/family satisfaction and length of stay in emergency department. Lastly, the effectiveness of new interventions should be measured in the short and long term for the purpose of evaluating and embedding sustainable practice change (Gagnon et al., 2016).

Theoretical frameworks are available to guide and inform practice change, research design and analysis; enhancing both the validity of a study and interpretation of results (Yamada and Hutchinson, 2014). Examples of implementation frameworks adopted for pain management in paediatric and neonatal settings (Kavanagh et al., 2007; Obrecht et al., 2014; Stevens et al., 2014) include the Promoting Action on Research Implementation in Health Services (PARIHS) (Kitson et al., 1998; Kitson and Harvey, 2016) and Evidence-Based Practice for Improving Quality (EPIQ) process (Stevens et al., 2014, 2016). Both attend to the critical elements of organisational context, engagement of stakeholders with evidence, and facilitation for successful implementation. Participatory and solution-focused approaches to organisational change have been successfully applied to improve paediatric pain management outside the emergency department, such as appreciative inquiry methods used by Kavanagh et al. (2008, 2010). Such approaches are aligned with the collaborative research agenda we outline above, fostering a person-centred ethos where staff are co-researchers in identifying, implementing and evaluating context-specific solutions (Walsh et al., 2017).

Research designs for organisational interventions must be able to demonstrate a causative relationship between the intervention and outcomes, and examine sustainability of practice change (Gagnon et al., 2016). Future single-site studies would extend current knowledge and strengthen causal inference with an interrupted time series design (Sanson-Fisher et al., 2014). Researchers could also strengthen current pretest-posttest designs with a concurrent control site, and ultimately seek to test innovations in larger multi-site cluster randomised controlled trials. Each of these designs further reduce the risk of selection bias and contamination and provide a higher level of confidence in study outcomes (Sanson-Fisher et al., 2014).

4.3. Limitations of current review

This integrative review was bound by the quality and methodology of the included studies, as few low bias studies have been conducted exploring paediatric pain in the emergency department. Of the 20 included studies only two applied a randomised controlled trial design with sequential allocation (LeMay et al., 2010; Tanabe et al., 2002). With a limited availability of randomised controlled studies we were unable to draw cause-effect conclusions.

5. Conclusion

Effective paediatric pain management in the emergency department remains a significant challenge. While family involvement has been embedded in many aspects of paediatric emergency care, it is poorly integrated into pain management practice in our emergency departments. There is little evidence of theory-informed approaches to the problem at an organisational level, or collaborative research designs recognising emergency department nurses as the experts in their own context. Practice change initiatives have not drawn on implementation science or evaluated sustainability. Unfortunately, these gaps in knowledge translation have contributed to poorer pain outcomes for children in the emergency department.

The way forward is to respectfully engage all stakeholders—children, parents and clinicians—to develop solutions applicable to the emergency department context. Guided by an implementation

framework, future research designed to creatively translate evidence into practice and facilitate change at a systems level is a priority. Developing emergency department practice cultures where everyone is empowered to speak up, assess and take action for pain is a prerequisite for the care families expect and nurses want to provide. Nurses working at the bedside are well placed to lead this transformation in paediatric pain management in the emergency department.

Funding source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contribution

All authors have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ijnurstu.2019.02.017.

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