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PEDIATRIC PROCEDURAL PAIN MANAGEMENT: A REVIEW OF THE LITERATURE

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Abstract: Research in the last two decades has revealed the complex nature of pain and has thereby improved the understanding, treatment, and management of pediatric pain by health care practitioners. However, a significant gap between knowledge and practice still exists. Pediatric pain remains under-managed. Several themes emerged in this literature review as factors influencing adequate pain management. These include: outdated beliefs about pain management; inconsistent use of evidence-based interventions; difficulties assessing children's pain; and the role of the values and beliefs of caregivers and practitioners. The literature indicates a high risk of deleterious consequences of under-managed pediatric pain, linking early health care experiences to later health-seeking behaviours. Implications for practice are considerable. Recommendations include: an individualized "3-P" approach combining pharmacologic, physical and psychological strategies; collaborative approaches eliciting expertise from caregivers and health care professionals across multiple disciplines; and utilizing interventions before, during, and after procedures.

Keywords: pediatric, acute pain management, hospital, procedure, long-term implications, intravenous.

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Pediatric pain management is a broad, complex topic that spans multiple disciplines. Considerable research and systematic reviews have been conducted across North America to address the management of pain in children. The last two decades in particular have brought substantial developments to the understanding of pediatric pain and its treatment (Kennedy, Luhmann, & Zempsky, 2008; Young, 2005**)**. The World Health Organization (WHO) and many international professional pain societies advocate that optimal pain management is not only good, ethical practice, but also a fundamental human right (Buscemi, Vandermeer, & Curtis, 2008). While there has been a marked increase in the understanding and treatment of pediatric pain, reviews of the literature show a significant gap in transferring this knowledge to standard clinical practice (Twycross, 2010; Young, 2005**)**. This paper offers a review of the literature regarding children's experiences of acute procedural pain, the impact of pain on children, factors affecting pediatric procedural pain management in hospital settings, and implications for practice. The body of research on specific pharmacological interventions to manage procedural pain is extensive, and to cover all of it is beyond the scope of this review.

Literature was obtained through the Cumulative Index to Nursing and Allied Health Literature [CINAHL], Medline, Web of Science, PsychINFO and Google Scholar databases. The keywords searched were: pediatric, acute pain management, hospital, procedure, long-term implications, and intravenous. Peer-reviewed, North American, scholarly articles were selected. The examined literature contained information gathered through qualitative and quantitative methodologies via chart audits, interviews with practitioners, caregivers, and children, and systematic evidence-based practice reviews. The search spanned literature over the last 20 years. Members of the "Pain Team" at the Stollery Children's Hospital in Edmonton, Alberta were consulted regarding relevant research in the field.

Myths Regarding Children and Acute Pain

The literature traces current pediatric pain management practices back to multiple historical myths surrounding children and their experiences of pain. The American Academy of Pediatrics/American Pain Society (AAP/APS) (2001), Kuttner (2004), and Olmstead, Scott, and Austin (2010) state that although research has disproven many of these myths, the following beliefs continue to subtly influence children's experiences of pain, as well as the responses to children's pain by caregivers and health care professionals:

1. Infants do not have nervous systems sufficiently mature enough to experience pain.
2. Pain is not life threatening and has no long-term effects.
3. Children will get used to pain.
4. Children have no memory of pain.
5. Children's explanations of their pain experiences are unreliable.
6. Opioid analgesics are dangerous and children may become addicted.
7. If children can be distracted or active they are not in pain.
8. If children say they are in pain, but do not appear to be in pain, the pain need not be treated.

9. There is a correct amount of pain for a given injury.
10. Pain builds character.

Children and Acute Pain

While considerable research has been conducted regarding pediatric pain management and progressive practices do exist, the literature shows a profound gap between theory and practice. Stevens et al. (2011) found in their review of eight Canadian pediatric hospitals that more than 75% of the children in the sample underwent painful procedures in a 24-hour period, 78% of these children received some type of pain management intervention, but only 25% of the interventions were specifically linked with a painful procedure.

Pain is considerably more complex than a predictable reaction to sensory stimulation (Czarnecki et al., 2011**)**. An individual's reaction to painful stimuli is influenced by their perception of pain and mediated by a host of proximal and distal factors such as age, developmental stage, emotional state, temperament, culture, previous experiences, type of procedure, coping skills, environment, and responses of caregivers and practitioners (Blount, Piira, Cohen, & Cheng, 2006; Czarnecki et al., 2011; Kuttner, 2004). Regardless of the illness or reason for the medical procedure or intervention, it is widely recognized that even the most "minor" procedures can cause significant distress, fear, and pain (Young, 2005).

Common procedures such as needle injections for immunizations, drawing blood, intravenous cannulation, or intramuscular medications tend to be the most frequent, painful, and dreaded procedures that children encounter (Blount et al., 2006; Blount, Piira, & Cohen, 2003; Kortesluoma & Nikkonen, 2006; McMurtry, Noel, Chambers, & McGrath, 2011). Fradet, McGrath, Kay, Adams, and Luke (1990, as cited in Blount et al., 2003) discovered 50% of children who go through venipunctures experience "moderate to severe distress or pain" (p. 217). Despite documentation that these procedures are highly painful and feared by children, and empirical evidence demonstrating the pain-relieving efficacy of topical anesthetic agents for needle injections, these interventions are frequently not utilized (AAP/APS, 2001; Blount et al., 2003; Czarnecki et al., 2011; Melhuish & Payne, 2006; Young, 2005).

Researchers have historically relied on adult perceptions to explain children's pain experiences, so research delving into children's personal accounts of pain is limited (Kortesluoma & Nikkonen, 2004, 2006). The qualitative data provided by Kortesluoma and Nikkonen's (2004) study of 4- to 11-year-olds' experiences of venipunctures for blood sampling provides insight into children's perceptions of pain. One of their primary findings was the clarity with which these children were willing and able to talk about their pain experiences. Children primarily used sensory words to describe their pain, and metaphors to explain their experiences such as, it felt "like fire inside", "like something moving in my body", or "like someone would tear my skin off or try to take pieces out of it" (Kortesluoma & Nikkonen, 2006, p. 220). The use of metaphors demonstrates the complexity of children's pain and the difficulty inherent in making the intense and subjective experience understandable to an outsider.

Age was recognized as a consistent key contributor to children's experiences of pain in Kortesluoma and Nikkonen's (2006) study and elsewhere in the literature (Blount et al., 2003; Czarnecki et al., 2011; Young, 2005). Kortesluoma and Nikkonen (2004) found that children's fears were related to their developmental understanding of their bodies and the effect of procedures on bodily function. Many children stated they were afraid they would bleed to death during blood sampling procedures, and feared bodily mutilation or permanent cosmetic damage. Age also impacted children's perceptions of the purpose of pain. Younger children frequently believed pain to be a form of punishment or a consequence for misbehaviour, a misconception unintentionally perpetuated by the comments of caregivers and professionals linking desired behaviour to the avoidance of a painful experience (Kuttner, 2004). Stotts et al. (2004, as cited in Czarnecki et al., 2011) studied 412 patients undergoing similar procedures and found that younger patients reported higher levels of pain before and after the procedure but no difference in pain intensity was reported during the procedure. Kortesluoma and Nikkonen (2004) advocate that optimal communication and assessment of pain occurs when professionals' assumptions about children's developmental ability to understand and express their pain are accurate. Kuttner (2004) thoroughly outlines the impact of developmental stages and common fears and misconceptions within each stage on children's pain experience, fear, and anxiety.

Additional procedures identified as extremely painful by children were suturing, the removal of sutures, the resetting of fractures or dislocations, IV insertions, post-operative treatment and therapeutic interventions, and the side effects of medication (Kortesluoma & Nikkonen, 2006**)**. Children rated their pain as exceptionally high when the experience differed from pre-procedural explanations. Children also reported that seeing the blood intensified their fear and pain; in contrast, they stated that covering up the blood or injury helped alleviate the pain (Kortesluoma & Nikkonen, 2006; Kuttner, 2004).

Role of Fear

The relationship between children's fear and pain is difficult to disentangle: As one increases, the other follows suit (Noel, McMurtry, Chambers, & McGrath, 2010). Health professionals report that the presence of fear makes assessing a child's pain more difficult, especially with younger children who do not have the cognitive ability to differentiate between the two states (Melhuish & Payne, 2006). Throughout the literature, many professionals refer to pain and fear or distress interchangeably. Like pain, fear is multifaceted, and is influenced by a variety of internal and external factors. Self-report tools have been created in an attempt to measure fear, but McMurtry et al. (2011) and Kuttner (2004) found little consistency in the use of these tools in hospital systems. These tools also offer mixed reliability when a child is experiencing intense fear and pain concurrently.

The literature suggests that multidisciplinary interventions implemented to manage pediatric pain are most effective when they consider and address the child's fear and pain. In their assessment of pain management strategies, the American Academy of Pediatrics/American

Pain Society (2001) concluded that opportunities for alleviating or decreasing pain exist beyond immediate procedures. They are present before, during, and after procedures, and are broader than pharmacological techniques alone. These strategies will be discussed later in this review. Page and Blanchette (2009) advocate that self-efficacy, or the belief in one's ability to manage his or her pain, is a crucial component of understanding and alleviating pain. Fear develops from feelings of powerlessness and lack of control; thus, interventions that increase self-efficacy, power, and control serve to decrease fear and perceptions of pain, building the capacity to cope with future frightening scenarios (Pate, Blount, Cohen, & Smith, 1996**)**.

Role of Memory

Current understanding of memory in relation to children and painful procedures has improved and evolved exponentially. A well-known landmark study by Taddio, Katz, Ilersich, and Koren, (1997, as cited in von Baeyer, Marche, Rocha, & Salmon, 2004) challenged the notion of infant memory recall for painful procedures and the impact of pain on infants. This study demonstrated that newborn infant boys circumcised without anesthesia demonstrated greater distress during their 4 to 6 month immunization injections than infant boys circumcised with anesthesia. An additional study by the same researchers (as cited in von Baeyer et al., 2004) compared infants of mothers with diabetes and infants with non-diabetic mothers. The infants whose mothers had diabetes displayed more intense pain reactions to the preparation of the skin for heel lancing and during the procedure itself. This study raised awareness that painful experiences are "remembered" from early infancy and impact future reactions to painful events. Research has continued to demonstrate that although children may have no conscious memory of early pain experiences, the noxious stimuli can permanently change neuronal circuits in the spinal cord that process pain, leading to lower pain threshold or central sensitization (Blount et al., 2003; Czarnecki et al., 2011; Fitzgerald, 2005).

Literature suggests that children can accurately recall details about painful experiences but this recollection is also susceptible to distortion (Steward & O'Connor, 1994). Younger children are particularly susceptible to memory distortions since their understanding of reality and fantasy is somewhat blurred (Kuttner, 2004; von Baeyer et al., 2004). Noel and colleagues' (2010) investigation (through observation and qualitative interviews) of children's memory of painful procedures demonstrated that how painful experiences are remembered powerfully impacts future reactions to medical procedures – in later childhood and potentially following them into adulthood. They suggest that for some children, memories of the painful procedures may be as important as the initial experience itself. Once an exaggerated memory of a painful procedure develops, it is a statistically significant predictor of pain and distress in subsequent procedures.

Fear, distress, and pain may have an impact on memory storage. Children who experience more pain and distress during medical procedures have fewer resources available to accurately store and "encode" the experience into their memories, thus leading to poorly organized or fragmented memories (Noel et al., 2010**)**. Additionally, Newcomer, Craft, Hershey, and Askins

(1994, as cited in Noel et al., 2010) noted that increased distress and cortisol levels may affect the hippocampus, influencing memory formation and recall. Distorted memories have powerful implications. They develop because of age-related developmental fears and misconceptions, the physiological impact of the distress, or because the negative memory is an accurate account of what occurred. Further evidence is cited supporting the value of eliciting recollections of children's memories as a means to anticipate reactions to painful procedures and help children create a more accurate understanding of the experience (Kuttner, 2004; von Baeyer et al., 2004**)**.

[V]on Baeyer et al. (2004) noted that situational factors may influence children's memory of procedures. One situational factor was the choice of words used by adults when asking children to draw out their memories: typically a yes-no format, open-ended questions, or specific "wh" questions such as "where did it hurt", "when did the hurt go away", etc. are utilized. "Wh" questions were found to be the most reliable. Children demonstrated a preference toward the affirmative, frequently responding with "yes" when asked a yes-no question and were unable to provide information to open-ended questions. Some success has also been documented with the use of props or encouraging children to draw pictures to depict their pain experiences (Kuttner, 2004; von Baeyer et al., 2004). Badeli, Pillai, Craig, Giesbrecht, and Chambers (2000, as cited in von Baeyer et al., 2004) tested the accuracy of children's recall of their pain over time. They found children could accurately recall previously reported pain intensity on a pain scale over a period of months and years, but it is unclear if they were remembering their pain experience or pain scale rating.

How caregivers and professionals talk with children during an event also influences the memory of the experience (von Baeyer et al., 2004**)**. During procedures, responding to children by articulating specific coping behaviours and directions to utilize these behaviours, rather than responding with apologies and comfort, builds capacity to cope with subsequent procedures. These positive coping behaviours are then stored in their memories, available for recollection at a later date (Blount et al., 2003). Additionally, when adults assist children to recall specific, concrete, positive aspects of the procedure when completed, they reframe the event with positive memories and continue to promote future coping skills and efficacy.

Cohen et al. (2001) studied the effect of psychological and pharmacological interventions on children's expectations and recollections of painful procedures and determined that it is possible for non-pharmacological interventions to positively impact children's memory, even if the intervention was "unsuccessful" during the immediate procedure. Health care professionals, in their study, employed interventions to decrease children's pain and distress during venipunctures. When compared with the control group, the interventions did not affect the children's immediate self-report of pain. However, they did achieve the creation of a "buffer" against negative exaggerations of pain that occurred in a control group of children not given the interventions. Therefore, even when the non-pharmacological intervention does not appear effective in alleviating children's immediate distress, it may have important and long-term effects for future experiences.

Role of Caregivers

The literature has identified a number of important ways that caregivers influence children's pain experiences: presence during procedures (Blount et al., 2003); transference of values and beliefs regarding pain (Kuttner, 2004); ability to assess their child's pain (Blount et al., 2006; Kuttner, 2004); and as discussed above, shaping memories to focus on positive or negative aspects of the pain experience (Cohen et al., 2001; von Baeyer et al., 2004). Hospital cultures have shifted dramatically in the last decade and a family-centred model is widely practiced, allowing and encouraging caregivers to be present during many painful procedures (Kuttner, 2004). The literature demonstrates an overwhelming preference on the part of both children and caregivers for the caregivers to remain with the child during painful procedures (Blount et al., 2003; Kuttner, 2004; Young, 2005). The value of this presence is well researched, and the reported effect varies, possibly depending on caregiver anxiety levels and coping skills, and health professionals' interactions with the caregiver (Blount et al., 2003; Steward & O'Connor, 1994; Young, 2005).

Blount et al. (2003) reviewed studies evaluating a caregiver's impact during procedures and found that caregiver behaviours accounted for 53% of the variance in child distress behaviour; children accompanied by anxious caregivers displayed more pain and distress than children accompanied by less anxious caregivers. Blount and colleagues identified specific caregiver behaviours and communication patterns likely to facilitate coping during painful procedures and those likely to promote increased distress. These will be highlighted further in the review. Page and Blanchette (2009) discuss the impact of caregivers' feelings of inefficacy in dealing with their children's pain on the child's confidence to manage the pain, increasing the distress and pain experience. The literature outlines how caregivers enabled or prepared to reinforce their child's coping strategies during procedures have a more positive impact on children's coping than unprepared or coached caregivers (Blount et al., 1997; Cohen et al., 1997, both as cited in Blount et al., 2003). Literature supports caregiver presence during painful procedures but highlights the role of health care professionals in coaching and guiding caregivers to engage in behaviours that promote coping.

Caregiver internal beliefs and attitudes towards pain influence how children express their pain and the treatment strategies children accept from the medical team. These values influence caregiver assessment of children's pain, and the coping behaviours they encourage children to utilize during the pain experience (Kuttner, 2004). Kuttner examines how children internalize messages about the purpose of pain from their caregivers' verbal and non-verbal messages. For example, encouraging children to cooperate with medical requests to avoid injections or painful procedures may achieve immediate behavioural results but send a message that painful procedures occur because of misbehaviour and/or punishment.

The difficulties of assessing a child's subjective experience of pain are well documented (Blount et al., 2006; Young, 2005) and will be discussed in a later section of this review. The review by the American Academy of Pediatrics/American Pain Society (2001) identifies the

unique role of caregivers in providing valuable contextual information to augment a child's self-report and help professionals interpret pain behaviours. The literature offers mixed reports regarding the reliability of caregiver reports, but the consensus among researchers is that caregiver input provides the context necessary to understand pain, and to predict pain and coping behaviours (Blount et al., 2003; Young, 2005). Manne, Jacobson, and Redd (1992, as cited in Kortesluoma & Nikkonen, 2004) emphasized the difference between professional and caregiver attention to children in pain. Where professionals attended to children's general distress behaviour, caregivers attended to the subjective interpretations of the pain as indicated by deviations from their typical behaviour. For example, professionals may perceive that stoic children are in less pain as their general distress is minimal, but a caregiver may observe stoicism as an unusual demeanour and perceive that fear may be hindering their expression.

The Impact of Pain

Impact on Children

The literature clearly indicates that pediatric pain is under-managed and that unmanaged pediatric pain has detrimental short-term and long-term consequences for children (AAP/APS, 2001; Buscemi et al., 2008; Czarnecki et al., 2011**)**. The literature suggests that younger children may be at a greater risk for long-term effects, as are children who experience repeated painful procedures **(**Buscemi et al., 2008; Czarnecki et al., 2011; Fitzgerald, 2005). Contrary to the historical myth, there is ample evidence that children do not get used to pain (AAP/APS, 2001; Buscemi et al., 2008; Noel et al., 2010). Clinical research and developments have disproven myths surrounding premature infants' experience of pain in the neonatal intensive care unit in the last decade (Krauss, 2001). Studies show, in addition to infant's remembering pain experiences, repeated painful procedures or other noxious stimuli may permanently alter the neuronal architecture, pain sensitivity, and processing of pain by an infant's developing brain (Blount et al., 2003; Czarnecki et al., 2011; Fitzgerald, 2005; Young, 2005**)**.

Assessing long-term effects of inadequate pain management is difficult, given the myriad of extraneous factors that could confound the results and the ethical irresponsibility of withholding known pain management interventions (Young, 2005). In addition, experimentally inducing pain, although previously practiced (LeBaron, Zeltzer, & Fanurik, 1989, as cited in Young, 2005), is ethically questionable. It is suggested that perhaps the pain response in subsequent procedures is the most significant indicator. Post-traumatic stress disorder (PTSD) symptoms have been used as a measure of long-term effects. Hobbie, Stuber, Meeske, Wissler, Rourke, and Ruccione (2000, as cited in Blount et al., 2003) identified that one-fifth of young adult survivors of childhood cancer (a disease requiring treatment regimes of frequent, invasive, and painful procedures) had diagnosable PTSD.

The relationship between pain memories and future painful procedures has been discussed above but the literature also links the development of debilitating conditions such as needle phobia to early negative experiences with needles (Noel et al., 2010). Willemsen,

Chowdhury, and Briscall (2002) note that needle phobia is quite common, prevalent in 2% to 4% of children and adults. The etiology is multifaceted and requires further research but many articles and studies indicate that needle phobia is a learned behaviour, traced to one adverse experience with needles in a medical or dental context (Kuttner, 2004; Noel et al., 2010; Willemsen et al., 2002). Ost (1991, as cited in Willemsen et al., 2002) found that 52% of individuals with needle phobia had a direct negative reaction to personal procedural experiences and 24% linked their fear to witnessing another child have an adverse experience. Willemsen et al. (2002) question the contentious issue of gently restraining children for medical procedures indicating that needle phobias do not stem solely from the pain in the medical procedure but also the fear and trauma intricately linked to excessive restraint (Taddio, et al., 2010).

Pate et al. (1996) explored the relationship between adult fear, pain, and coping effectiveness and childhood medical experiences and temperament. Young adults in their study completed a *Medical Experience Questionnaire* (designed by Pate et al.) and the *Dimensions of Temperament Scale*, (Windle & Lerner, 1986, as cited in Pate et al.). Regression analysis was utilized to determine the relationship between adult fear, pain, and coping effectiveness, and childhood medical experiences and temperament. The results demonstrated that childhood fear, pain, and coping effectiveness during painful procedures were significant predictors of adult experiences. Further, this study identified that childhood pain accounted for greater variance than fear and temperament. Behaviours seen in these young adults with adverse childhood medical experiences were excessive fear, pain, decreased coping strategy effectiveness, and avoidance of medical situations. The avoidance of medical situations ranged from avoiding medical procedures, avoiding doctor visits, and refraining from entering hospitals. Some of these adult behaviours come at large economic costs to society (Buscemi et al., 2008; Kuttner, 2004**).** Early childhood appears to be a critical period for the development of medical attitudes and behaviour.

Weisman, Bernstein, and Schechter (1998) studied the effects of inadequate analgesia for painful pediatric procedures. Their anecdotal experience and qualitative study demonstrated that inadequate analgesia for young children undergoing painful procedures might diminish the effect of adequate analgesia in future procedures. These children may anticipate that their next procedure and pain experience will be similarly negative. If their fear is greater, an increased amount of analgesia may be needed to calm their anxiety and control the pain. Older children with the cognitive ability to understand that medication given during subsequent procedures would reduce pain responded more positively. The authors stressed that if and when analgesic interventions are used, it is crucial that sufficient quantities to adequately manage the pain be utilized from the start.

Olmstead et al. (2010) noted that when children experience pain, the stress hormones released from their body may cause increased heart rate and blood pressure, weakened immune systems, and possible delay in healing. Sleep cycles are affected, and valuable energy needed for growth and healing is stolen to cope with pain (Czarnecki et al., 2011). With a delay in healing there is also a risk for prolonged hospitalization. Research shows that prolonged hospital stays

have the potential to cause multiple adverse reactions, trauma, and pain for children (Kuttner, 2004; Thompson & Stanford 1981).

Impact on Caregivers and Professionals

The impact of children's pain extends beyond the child; Kennedy et al. (2008) emphasize the impact of children's pain on their caregivers. Individuals observing a loved one receiving a painful stimulus may also experience a degree of pain response, for example increased heart rate, blood pressure, and anxiety (Kennedy et al.). Caregivers in Kuttner's (2004) studies stated that feelings of helplessness and the necessity of depending on strangers to relieve their child's pain were excruciating experiences. This helplessness, especially when the pain is perceived to be under-managed may exacerbate caregivers' anxiety, which in turn impacts children's anxiety, fear, and pain. A child's pain becomes intimately experienced as the caregiver's pain. Literature stresses the valuable role of parents in assessing and interpreting children's pain and coaching behaviours that promote coping for the child and also themselves (Kuttner, 2004).

Olmstead et al. (2010) suggested that the pain experiences of a child might place additional stress on the hospital system and health professionals. In addition to a potentially prolonged hospital stay, procedures with a highly agitated and fearful child are more time consuming and involve more staff members than procedures with less fearful and anxious children with effective coping strategies (Kennedy et al., 2008). Health care professionals also report that performing painful procedures on fearful and anxious children is particularly challenging. Nagy's (1998, as cited in Kennedy et al.) comparative study of patient pain effects on nurses found morale was lower among nurses working on units with frequent painful procedures, and has been linked to perceived challenges to images of themselves as alleviators of pain.

Factors Influencing Pain Management

Given the multitude of literature stressing the necessity of managing pediatric pain, the important question is this: Why is procedural pain not being managed more effectively? Just as a child's experience of pain is subjective and impacted by multiple social, emotional, and environmental factors, the literature identifies numerous factors that make managing pediatric pain difficult.

Assessment

A frequently identified barrier to treating children's pain is the ability to accurately understand the level of pain children experience (Blount et al., 2003; Young, 2005). Pain is assessed through self-report, behavioural observation, physiological measures, or a combination

of these means (AAP/APS, 2001). Comprehensive, reliable, evidence-based measurement tools have been developed and are well researched in the literature (Blount et al., 2006). A complete review of these assessment tools, however, is beyond the scope of this paper. Given that pain is a subjective experience it is very difficult for an outsider to understand another's pain experience. For this reason the literature suggests that when available, self-report is the "gold standard" for measuring pain (AAP/APS, 2001).

The age at which children can accurately report their pain varies in the literature and is in all likelihood impacted by the pain vocabulary and previous experiences of the children across the studies. The consensus among prominent professionals in the field is for health care professionals to utilize a combination of self-report tools and behavioural observations for assessment with young children. Researchers have demonstrated that children as young as 3 years old have the ability to identify, locate, and describe specifically salient pain sensations when given appropriate tools and guidance (Kortesluoma & Nikkonen, 2004; Kuttner, 2004). The most common scales are numeric or pictorial. Numeric scales ask children to ascribe a numeric value from 1-10 to their experience of pain. Pictorial scales offer a thermometer or various face images and ask children to choose one that accurately represents what they are feeling (Young, 2005). However, these measures do not provide a means to distinguish between pain and emotional states such as anger, sadness, anxiety, and fear (Blount et al., 2006).

Kortesluoma and Nikkonen (2006) highlight the prominent use of metaphors by children to express the pain they were experiencing. They argue that perhaps the inanimate images on the scales fail to recognize the complexity inherent in describing one's pain experiences. Kuttner (2004) has demonstrated success interpreting children's drawings of their pain. The literature recognizes a need for further research into the area of incorporating children's drawing into assessment strategies (Kortesluoma & Nikkonen, 2006).

Observational measures refer to adults' assessment of children's overt behaviours. Pain behaviours such as facial expressions, crying, kicking, verbal protests, and the need for restraint are observed and scaled to correspond to pain levels (Young, 2005). Kortesluoma and Nikkonen (2004) found frequent discrepancy between nurses' observations and children's reports, which raises the question "when measures disagree, which one is to be considered valid?" (Blount et al., 2006, p. 32). The AAP/APS (2001) point out that one danger in preferring adult observation over children's self-reporting is the assumption that a "stoic or well behaved" child is not actually in pain. Numerous factors influence their outward expression of pain. Kuttner (2004) and the AAP/APS (2001) advocate for the crucial role of caregivers and others who know the children well to interpret pain behaviours in relation to their typical behaviour rather than solely relying on comparisons of typical procedural responses.

Physiological monitoring measures individuals' heart rate, vagal tone, blood pressure, and cortisol. These measures may be particularly valuable with infants and children with special needs but are cautioned throughout the literature to be used as corroborative data (Taddio et al., 2010; Young, 2005). While these appear to be a more objective and valid measure of distress,

some argue they are time consuming, costly, invasive, and introduce extraneous distressing factors that may affect the reliability of measurement (Blount et al., 2006**)**.

Practitioner Values and Beliefs

Research exploring the attitudes of health professionals regarding pediatric pain management is plentiful and presents a general consensus: Health professionals' values and beliefs influence the treatment of children's pain (Melhuish & Payne, 2006; Twycross, 2010; Young, 2005). The literature shows that current values still run the risk of being influenced by the historical myths highlighted at the beginning of this discussion. One attitude directly linked to these myths is that if a child can be distracted or active they are not in pain. Studies have found that distracting oneself from the experience of pain and shifting one's attention to more pleasant stimuli is a positive coping strategy, not an indication that the pain has subsided (Kuttner, 2004). Literature illustrates the positive impact of distraction strategies as a non-pharmacological intervention during procedures, especially when used alongside pharmacological techniques such as topical anesthetic to address the pain (Blount et al., 2003; Czarnecki et al., 2011; Uman, Chambers, McGrath, & Kisely, 2008).

As professionals observe the private and subjective experience of a child in pain, it is perceived through their professional, yet subjective, lens. The results of Brunier, Garson, and Harrison's (1995) study (as cited in Kortesluoma & Nikkonen, 2004) into nursing attitudes revealed 44% of nurses in the study accepted a doctor's assessment of a child's pain over the child's self-report. Goodenough et al. (1997, as cited in Kortesluoma & Nikkonen, 2004) also highlighted the discrepancy between the self-reports of children and the reports of practitioners, noting that professional assessments often underestimate the intensity of the experience of pain. Kuttner (2004) and Blount et al. (2003) counter this belief demonstrating that a child's self-report can be accurate when given appropriate time and tools, and must be attended to in order to counter the potential consequences of under-managed pain.

Melhuish and Payne (2006) discerned that professional beliefs about pain management do not always coincide with actual behaviour in practice. Their study demonstrated that professionals believed infants and young children felt more pain and distress with venipunctures than older children. In practice, however, they used a topical anesthetic cream 24% less often for the younger children than with the older group. Nurses reported pressure to "get the procedure over with quickly" (p. 22) and did not have time for the cream to take effect. Health care practitioners in Czarnecki et al.'s (2011) report noted that co-worker knowledge of a "better way" to perform procedures created a barrier to pain management. Alternatively, Walco, Cassidy, and Schechter (1994) found that professionals have withheld particularly effective analgesics with young children because the children's fear of the needle and intramuscular injection was so great. Additionally, according to qualitative studies by Hamers, Huijer, Halfens, and Schumacher (1994, as cited in Kortesluoma & Nikkonen, 2004), nursing staff responses to a

child's pain were influenced by children's medical diagnoses. If the diagnosis was serious, they were more likely to assess the pain as more severe.

Fears regarding the safety and efficacy of analgesic interventions also impact pain management (Olmstead et al., 2010). Although research has demonstrated the safety of various analgesics and guidelines abound (Krauss, 2001), the literature demonstrates a gap in front-line staff consistently applying this knowledge to current practice (Czarnecki et al., 2011; Twycross, 2010). Twycross (2010) linked this gap to the possibility that staff do not necessarily understand the rationale behind pain relieving strategies. Studies have demonstrated that some nursing staff determined a doctor's order of "PRN" or pro re nata pain relief to mean "as little as possible", rather than "when necessary" (Kortesluoma & Nikkonen, 2004). Melhuish and Payne (2006) identify that often those professionals providing direct care have the most misconceptions about pain management.

Cohen et al. (2001) revealed that professional biases about interventions (such as topical anesthetic creams) or psychological interventions (such as distraction) might influence the effectiveness of these pain management techniques. As coaches and role models for children and caregivers, health care professionals send valuable messages that may influence caregivers' acceptance of interventions and children's willingness to engage (Kuttner, 2004). Research highlights the important role of professionals as coaches to facilitate successful coping behaviour in children and caregivers during procedures. Blount et al. (2003) found caregivers and professionals continually cue one another about how to helpfully interact with the child and encourage success. Studies indicate that children's distress is much lower when communication and cooperation between health professionals and caregivers is high, and when they effectively coach the children to use behaviours that promote coping.

Conflicting perceptions about the goals of pain management and of pain relief also impact how children's pain is managed. Burokas (1985, as cited in Olmstead et al., 2010) reported that 16% of nurses reported a management goal of complete pain relief, and 23% reported a management goal of pain relief to a level that allowed children to be "functional". Burr (1993, as cited in Melhuish & Payne, 2006) identified a perception that a "usual amount of pain" exists for a given procedure and Hamers et al. (1994, as cited in Melhuish & Payne, 2006) reported beliefs among practitioners that some pain should be allowed, since the children were in the hospital.

Environment

The literature suggests that the hospital environment plays an important role in children's experiences of pain, both how they experience pain and how their pain is treated (Kuttner, 2004; Thompson & Stanford, 1981; Young, 2005**)**. Young (2005) described the emergency department as "chaotic, noisy and frightening for young children" (p. 165). This environment potentially increases children's distress before they experience a painful procedure making their pain more difficult to assess, and adding to their general distress and trauma. Children's responses to

unfamiliar environments vary, especially one as hectic and novel as a hospital. Therefore, their expression of pain may be subdued or heightened in response to the new environment (Thompson & Stanford, 1981; Young, 2005). Another factor to consider when treating children's pain is the influence of witnessing the experience of others. The impact of vicarious fear through witnessing the distress of another is well documented (Willemsen et al., 2002). Observing or hearing other children's distress and expressions of pain may increase children's experiences of distress, fear, and pain.

Young (2005) also discusses the impact of environment on staff, citing that many feel rushed and justify "holding [a child] down and quickly performing procedures as the most compassionate alternative available" (p. 165), rather than embracing evidence-based comfort measures (Czarnecki et al., 2011). Melhuish and Payne (2006) also noted that the pressure imposed on health professionals by the health care system to perform procedures quickly often contradicts their values of providing pain management strategies. Gimbler-Berglund, Ljusegren, and Enskar (2008, as cited in Czarnecki et al., 2011) found nurses cited one barrier to effective pain management as a lack of time before procedures to administer medication or pain management interventions. Additionally, professionals in Ellis, Sharp, Newhook, and Cohen's (2004) study expressed that a lack of communication and coordination between practitioners in ordering, implementing, and supporting children through procedures hindered their ability to utilize effective pain management interventions.

The literature identifies organizational factors as barriers to adequate pain control. Research has demonstrated the value of pain teams comprised of multidisciplinary professionals with specialized knowledge in the area of pain management but not all hospitals have these teams and systemic complications delay referrals to these teams when they do exist (Blount et al., 2006**)**. If pain management is to be a priority, which the World Health Organization has determined to be a fundamental right, Twycross (2010) suggests that organizational structures must undergo a massive change in attitude, culture, policies, and practices. Given the potential for long-term effects of poorly managed pain in children, research demands the notion of "cost" be re-examined (Young, 2005**)**.

Olmstead and colleagues (2010) note that many health care systems lack support for nurses to pursue up-to-date evidence-based knowledge to inform their practice. Twycross (2010) suggests a need to revisit course content in training or to provide additional education to close this gap. Given the crucial role of adult attitudes, behaviours, beliefs, and values towards pediatric pain management and new research in the field, ongoing education for practitioners and community members working with children in pain appears crucial (AAP/APS, 2001**)**.

Ethics

The discourse surrounding pain management poses a number of ethical questions, and many state that under-management of pain in children challenges the fundamental ethical

responsibilities of health care professionals (Czarnecki et al., 2011; Olmstead et al., 2010). The literature recognizes the complexities surrounding pediatric pain management but stresses that health professionals have an ethical responsibility to apply current research findings to pain management practices (Buscemi et al., 2008; Olmstead et al., 2010). Walco et al. (1994) suggest that the principle within responsible medical care to "do no harm", presents an ethical conflict since pain has been proven to be harmful to children. Brennen et al. (2007, as cited in Czarnecki et al., 2011) stated, "the unreasonable failure to treat pain is viewed as an unethical breach of human rights" (p. 101). While pain management is complicated and an immense task, the literature presents a united position that children have a right to have their pain managed effectively.

Implications for Practice

Recommendations for improvements to pediatric pain management are plentiful. Recommendations for specific analgesic guidelines are beyond the scope of this review, though the literature does stress the evidence-based support for utilizing analgesics to treat pediatric pain, dispelling myths of opioid dependency (Buscemi et al., 2008; Krauss, 2001). The literature recommends that effective pain management be based on a "3-P" approach, combining pharmacologic, physical, and psychological strategies, and the expertise of health care professionals from various disciplines to address the multiple dimensions of the pain experience (AAP/APS, 2001; Taddio et al., 2010). The review by Stevens et al. (2011) of Canadian hospitals indicated inconsistency in the incorporation of multidisciplinary approaches to pain management. Interventions were embraced but the prevalence of documented combined strategies was very low. Taddio et al. (2010), in their review of this "3-P" approach, clearly outline a series of approaches to pain management for hospitals to consider that do not require the expenditure of additional resources.

Walco et al. (1994) and Pate et al. (1996) recognize that while the total eradication of pain may not be realistic, strengthening children's and caregivers' capacity to cope is crucial to combatting potential deleterious consequences. The literature supports this stance promoting cognitive behavioural therapy or other psychological approaches as a complement to pharmacological interventions, topical or analgesic (Blount et al., 2006; Kuttner, 2004; Page & Blanchette, 2009; Taddio et al., 2010).

As this review has shown, children's pain experience is directly influenced by their fear and anxiety. Thus the American Academy of Pediatrics/American Pain Society (2001) maintains that the key to managing procedural-related pain is anticipation. Much has been written about the value of procedural preparation (Blount et al., 2003; Gaynard, Wolfer, Goldberger, Thompson, Redburn, & Laidley, 1998; Kuttner, 2004; Thompson & Stanford, 1981). Cohen et al.'s (2001) study of children's expectations and memories of acute distress found that children do not necessarily experience comfort when informed they will receive an intervention to target the

distress. Additionally, research into preparation programs has proven that information alone is not effective (Page & Blanchette, 2009). Children's reports in the qualitative study of Kortesluoma and Nikkonen (2006) stress the importance of providing accurate information about what a child will experience, rather than stating whether or not it will hurt. Gaynard et al. (1998) and Kuttner (2004) offer detailed explanations of thorough, age-appropriate preparation strategies. Preparation can combat potential exaggerated negative memories of procedural pain. As anxiety and distress decrease, children have more focused resources to encode the event accurately and create more positive memories to draw from in the future (Noel et al., 2010).

Clinical reviews and studies (Blount et al., 2006; Taddio et al., 2010) recognize a number of coping-promoting behaviours that professionals and caregivers can embrace during procedures that cause the most distress to children (i.e., needles). Taddio et al. (2010) advocate that to reduce pain and distress during injections children should not be placed in a supine position but seated or held by a caregiver in a secure yet comforting position. Literature suggests that excessive restraint may increase distress, anxiety, and perceptions of pain (Kuttner, 2004; Taddio et al., 2010; Young, 2005). Taddio et al. (2010) also recommend the use of topical anesthetic creams prior to injections.

The research reviewed here in general argues that the most effective way to reduce the distress of children and caregivers during procedures is to equip them with knowledge and new ways to promote success (Pate et al., 1996). Caregiver and professional behaviours that promote coping during procedural pain have been identified as strategies that are individualized to match a child's temperament, concretely redirect children to utilize individualized coping strategies, or refocus attention from threatening or painful aspects of the treatment to something more positive. Adult behaviours such as apologies, reassurance, empathetic statements, or commands to "relax" have been found to be unhelpful (Blount et al., 2006; Kuttner, 2004).

Empirical evidence has emerged regarding the role of the mind-body connection and the experience of pain (Evans, Tsao, & Zeltzer, 2008; Kuttner, 2004). Various alternative methods of focusing on the mind's ability to reduce symptoms have surfaced, particularly hypnosis, music therapy, and thought-stopping practices. Blount et al. (2003) state that although these strategies have been practiced for a number of years, few evidence-based studies demonstrating their efficacy in pediatric pain in a hospital setting exist. Some research suggests that a possible role exists for these strategies in pediatric pain management, though further research is required to gather empirical evidence to establish their effectiveness (Evans et al., 2008). Uman et al. (2008), however, completed a thorough systematic review and meta-analysis on the efficacy of psychological interventions for managing pediatric needle-related procedural pain and distress, and found hypnosis, cognitive behavioural therapy, and distraction received the most positive support for their effectiveness.

Limitations of the Literature

While gathering information for this literature review, several gaps in the literature were noted. Uman et al. (2008) identify their study as the most comprehensive meta-analysis reviewing psychological interventions for the management of pediatric procedural pain to date. When conducting the meta-analysis, these authors noted that individual studies referenced and resourced throughout the literature have markedly different sample sizes, methodologies, and outcome measures making them very difficult to compare. Uman and her colleagues also indicated that many studies in the area of pain management were not random controlled trials, and thus did not have the same stringent criteria to qualify for inclusion in the meta-analysis. While the results of this meta-analysis are consistent with previous reviews by Blount et al., (2003) and individual trials, Uman et al. (2008) advocate for more randomized controlled trials to contribute empirical evidence for the use of psychological and non-pharmacological interventions for pain management.

Although the literature gathered for this review described a variety of methodologies, the articles or reviews did not embrace mixed research designs. For example, the reviews of Canadian hospitals conducted by Stevens et al. (2011) and Taddio et al. (2010) collected data via chart audits, while studies such as those conducted by Pate et al. (1996), Blount et al. (2006), and Kortesluoma and Nikkonen (2004), consisted of data collected via interviews and observations. Few studies offer a combined methodology, which may offer a more accurate depiction of practice, values and beliefs, and children's experiences.

Conclusion

The topic of pain and pain management in children is complicated. The current literature is comprehensive and plentiful, making a succinct review difficult. Knowledge of the multitude of influences on a child's experience of pain and the impact of that pain experience has increased exponentially in the last two decades. These insights and developments have given professionals effective tools to more competently manage children's acute pain. Despite the expansive growth of knowledge and the development of effective evidence-based strategies to manage pain, a distinct gap between knowledge and practice remains – what we know is not being implemented effectively. The multiple reasons for this gap have been explored but perhaps the greatest barrier lies with continued acceptance of outdated views of pain, despite evidence indicating the folly of such beliefs. Supportive guidelines, protocols, and new strategies have been developed but professionals' attitudes and the culture of hospital systems must adapt to address the right of children to have their pain recognized and effectively managed.

With the ever-increasing demands on the health care system, utilizing cost-effective intervention strategies is increasingly imperative. Despite faulty beliefs that pain management interventions must be costly, Taddio et al. (2010) espouse concrete pharmacological and psychological interventions to reduce venipuncture pain at minimal additional cost to the system. They argue the small costs accrued are likely to be offset by "shortened duration of procedure

[due to decrease in children's distress and struggle] and faster recovery time" (p. 6). Taddio, Soin, Schuh, Koren, and Scolnik (2005, as cited in Kennedy et al., 2008) compared the success rate and duration of IV cannulation procedures among pediatric patients with topical anesthetic and with a placebo. In addition to managing the pain of the needle insertion, procedures were completed with a higher success rate and within a shorter time frame. Thus in addition to the short-term and long-term impact on children and caregivers, pain management interventions are also important practices within the hospital system that save money and time.

Pain management interventions advocated by the AAP/APS (2001) are those that anticipate pain and distress, and combine pain management strategies with preparation for children and caregivers to increase behaviours that promote coping. Effective pain management strategies are multidisciplinary, proactive, anticipatory, and formed to meet the assessed needs of each pediatric patient. The potential ramifications of poorly managed procedural pain are staggering and the obligation to improve practice is evident. The effective management of pain is, after all, a fundamental human right.

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