LEARNING TO SHOW “IT HURTS!”:  
THE ROLE OF DEVELOPMENTAL FACTORS IN PREDICTING YOUNG CHILDREN’S USE OF SELF-REPORT SCALES FOR PAIN

by

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Abstract

Research that can be used to improve pain assessment in clinical settings and inform management plans for children coping with pain is critical. The current study examines young children’s use of self-report scales for pain and describes the role of several developmental factors in predicting young children’s use of this scale. The factors considered were: numerical reasoning, language, overall cognitive development, and age. One hundred and six children, ages 3- to 6-years-old, were tested on their level of development regarding the factors listed above. Their ability to accurately use a standard faces pain scale was measured using a series of hypothetical vignettes depicting pain scenarios common in childhood. Results indicated that 5- and 6-year old children were significantly more accurate in their use of the self-report pain scale than 4-year-old children, who in turn were significantly more accurate in their use of the scale than 3-year old children. However, even the 6-year-olds demonstrated difficulty using the pain scale. Child age was the only factor to significantly predict children’s accurate use of the pain scale. The results of this research highlight the pervasive over-estimation of young children’s abilities to use self-report pain scales and the need for screening tools and training tasks to be developed for use with the scales.
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Introduction

Pain

Definition of pain. Pain is a universal experience that spans age and language barriers. Pain is described by the International Association for the Study of Pain as “an unpleasant sensory and emotional experience that is associated with actual or potential tissue damage, or described in terms of such damage” (Merskey & Bogduk, 1994, p. 210). As this definition implies, pain is complex. It is not limited to a representation of the amount of physical trauma that occurs, but rather is heavily mediated by a person’s thoughts and emotions. For example, pain can be reported as mild even when there is a great deal of tissue damage. Conversely, pain in those anxiously anticipating distress can be rated as severe even though the apparent tissue damage associated with this pain is minimal (Pasero, Paice & McCaffery, 1999). In sum, although pain is an experience shared by nearly all human beings, the experience of pain is subjective and is influenced by an individual’s cognitive, behavioural, and emotional responses (McGrath & Gillespie, 2001).

Classification of pain. Several classification systems have been developed to describe pain. These systems are not mutually exclusive. In fact, pain can be most accurately described when it is categorized according to several dimensions. For example, pain can be classified based on its temporal characteristics. Acute pain is brief and subsides as physical healing occurs (Pasero et al., 1999). Chronic pain either persists beyond the normal time of healing for an injury, persists without an identified medical cause, or is recurrent over a long period of time (McGrath, 1990). Another way of classifying pain is to differentiate the ways pain can be caused. Nocioceptive pain occurs
when musculoskeletal structures or internal organs are stressed. In contrast, neuropathic pain occurs when the nervous system itself is damaged. In addition, pain can also be categorized in terms of triggers that cause stimulation (i.e., diagnosis) (Turk & Melzack, 2001). In this type of classification system, pain types can include maturational, injury-related, disease-related, and procedural pains. Determining how to best assess and treat a person in pain requires a careful understanding of the type of pain present. Pain measures and intervention methods may vary as a function of the type of pain being considered. Unfortunately, there is considerable evidence that clinically significant acute pain is often poorly controlled (McGrath & Unruh, 1987). Furthermore, chronic pain, by definition, represents failures in understanding the nature of pain and unsuccessful efforts at clinical intervention (McGrath & Unruh, 1987). There is a strong need for continuing research aimed at improving pain assessment and treatment.

Pain in Children

The prevalence of pediatric pain. Pain is a common experience for children. Fearon, McGrath and Achat (1996) reported that a sample of fifty-six 3- to 7-year-olds experienced over three hundred ‘everyday’ pain incidents while playing at daycare during 120 hours of field observation; this roughly equates to one pain incident per hour for each child. These incidents involved various body locations, with the most commonly affected areas being the head, neck, face, hands, and knees. The average duration of distress in response to a pain incident was relatively brief at 7.9 seconds. Girls were found to display distress responses to pain incidents more often than boys (Fearon et al., 1996). These everyday instances represent a frequent source of pain for children.
Pain is also a common experience for children in hospital. Cummings, Reid, Finley, McGrath and Ritchie (1996) conducted a survey study of pediatric inpatients in a tertiary care hospital. Children were interviewed regarding the intensity and source of their pain as well as perceived help for their pain over a 72 hour period. Approximately half of the children indicated their worst levels of pain to be in the clinically significant range. As reported by children, the most common sources of their worst pain were disease, intravenous punctures, post-operative pain, and miscellaneous medical procedures. Nurses, mothers and doctors were all endorsed as sources of help for pain, however, ‘no one’ was also a common response. As highlighted in this study, medical procedures are a common source of pain for children.

Pediatric procedural pain. Children experience a myriad of medical procedures while in hospital. Examples of common sources of procedural pain for children include injections, intubations, dressing changes, bone marrow aspirations, and lumbar punctures. Immunizations are also a common source of procedural pain for children and, in Canada, are typically administered six times before children reach kindergarten (National Advisory Committee on Immunization, 1998). These pain experiences are commonly believed to be undeserving of treatment by medical staff, despite the fact that medical procedures are often associated with intense levels of pain (McGrath & Unruh, 1987).

In the short-term, procedural pain is associated with increases in child and parent distress, anxiety, and fear (Kazak & Kunin-Baston, 2001). Infant behaviour has been shown to be responsive to a single painful procedure in terms of cry and reflex sensitivity (Taddio, 1999). The long term effects of procedural pain are just now beginning to be understood (Tadio, 1999; Grunau, Whitfield, & Petrie, 1994). Prolonged hospitalization
in infancy has been shown to relate to later pain sensitivity (Grunau, Whitfield, & Petrie, 1994) and to the development of conditioned anxiety responses (Taddio, 1999). Poorly assessed and treated procedural pain can cause older children to develop generalized maladaptive coping strategies, such as pain catastrophization and hypervigilance to bodily symptoms (Kazak and Kunin-Baston, 2001). The potential short-term and long-term effects of this type of pain make it critical to thoroughly understand, assess, and treat.

Pain Assessment in Children

Understanding an internal experience like pain relies upon the ability to accurately assess another person's pain. Pain assessment is complicated because the experience of pain is complex and subjective in nature and requires consideration of physical perceptions, emotions, and cognitions (Gaffney, McGrath, & Dick, 2003).

An assessment model of pediatric pain. A Sociocommunications Model of pediatric pain has been put forth by Craig and colleagues (Craig, Lilley & Gilbert, 1996; Craig 2002) to describe the complex interactions between children and their environment in the context of pain assessment (see Figure 1). Pain is initiated in the child with tissue damage. The pain experience, which involves a child's thoughts, feelings, and sensations, is influenced by the child's internal biological environment and his or her social history with pain. The child's pain expression can be accessed by verbal self-report and/or physical display, as determined by the child's motor systems, ability to communicate, and knowledge of social expression rules. Caregivers' assessments or attributions about the child's pain require caregivers to attach meaning to the expressive signals displayed by the child. This process of 'decoding' is influenced by a caregiver's
relationship to the child, as well as by a caregiver's own knowledge and beliefs about pain. A caregiver's response to the child's pain may involve administering analgesic medication or initiating cognitive behavioural strategies, such as imagery, to treat or help the child cope with the pain (Craig et al., 1996; Craig 2002). The model's strengths lie in its inclusion of multifaceted biological, environmental, and social factors that influence each of the model's main components.

As exemplified in this model, pain assessment, although challenging, is a vital precursor to the optimal management of pain in children. Without adequate pain assessment, children in medical environments run the risk of being improperly medicated or denied the benefits of psychological pain management techniques (e.g., guided imagery, relaxation breathing). In order to address the many challenges involved in assessing pain in children, various methods of pain assessment have been developed. All assessment measures focus on describing pain along one or more dimensions including the intensity, quality, location, affective impact, and/or functional impairment associated with the pain (Champion, Goodenough, von Baeyer, & Thomas, 1998). Most measures focus on quantifying pain intensity. In general, measures can be classified into three groups: physiological measures, behavioural measures, and self-report measures (McGrath & Gillespie, 2001).

Physiological and behavioural measures. Physiological and behavioural measures are designed to provide an objective of the pediatric pain experience. Physiological measures monitor bodily reactions to pain such as heart rate, blood pressure, and sweating, and provide a general description of the child’s response in terms of physical stress cues (Sweet & McGrath, 1998). In behavioural measures, criterion-explicit
behavioural responses to pain are coded and composite pain scores are generated. Coded behaviours include facial expression, torso and limb movements, crying, sleep patterns, breathing, and muscle tension. A commonly used and well-validated measure to assess procedural pain in young children is the Children’s Hospital of Eastern Ontario Pain Scale (CHEOPS) (McGrath et al., 1985) where pain behaviours, such as facial expression, cry, verbalisation, torso, and leg movements are coded for their presence and intensity by a health provider. There are several barriers to the use of physiological and behavioural measures in clinical practice (McGrath, 1998). These measures often require observation and recording by a trained outsider, such as a doctor, nurse, or clinical psychologist. Further, some measures require special equipment or the use of a video camera. Although these demands can limit the utility of behavioural and physiological measures in clinical settings, they are highly precise and psychometrically rigorous means of assessing pain in young children.

**Self-report measures.** Despite the growing popularity of physiological and behavioural methods, self-report measures are the most commonly used methods for assessing pain, both clinically and in research (Champion et al., 1998). Self-report measures in children should be part of a multi-method assessment process that incorporates data from other measures of pain, such as behavioural and physiological measures. Reliance on self-report measures in pediatric pain assessment likely is due to the ease with which these measures can be administered and scored. Reports of pain can be obtained indirectly from parents (parent-report) or directly from the child (self-report). Self-reports of pain obtained directly from the child are typically preferred, as research has found that parents systematically under-report pain in their children (Chambers, Reid,
In addition, parents are not always available in hospital when their children are in pain. Self-report measures can generally be divided into two types: interview/questionnaire tools and pain rating scales.

**Interview and questionnaire measures.** Interview and questionnaire measures usually consist of a series of structured questions about various aspects of a child’s pain experience; they are most often used to assess chronic pain in children. The Varni / Thompson Pediatric Pain Questionnaire (PPQ) (Varni, Thompson, & Hanson, 1987) is an example of a commonly used interview measure. Children are asked to use a word-list to describe their pain, to indicate the places on their body where they have pain, and to provide an account of the precipitates and maintenance factors of their pain. In general, these measures appear to place heavy demands on children’s cognitive resources, as they require sophisticated language comprehension and production, as well as sustained attention and memory. Other variables such as question-type and the child’s rapport with the interviewer pose the potential for biased results when using these forms of measurement (Ross & Ross, 1984).

**Pain rating scales.** Pain rating scales, on the other hand, are uni-dimensional measures of pain that focus more explicitly on pain intensity; they are used to assess acute pain in children. A large number of different self-report pain rating scales for children exist and vary in terms of their physical presentation and content (Champion et al., 1998). The Visual Analogue Scale (VAS) is a measure commonly used with adults (Huskisson, 1974). It requires the patient to indicate the intensity of his or her pain by translating the pain experience into a number on a line between 0 and 5, 0 and 10, or 0
and 100. A modified version of the VAS is the Coloured Analogue Scale (CAS; McGrath et al., 1996), where children indicate their level of pain on a colour spectrum. The colour smear begins on the bottom as a light, narrow band and spreads up to a band of colour that is progressively wider in width and darker in shade. Another type of self-report pain rating scale is the Poker Chip Tool (Hester, Foster, & Kristensen, 1990), where children indicate their level of pain by choosing between one and four “pieces of hurt.”

**Faces pain scales.** Faces pain scales are the most common self-report pain rating scale used with children. These scales require children to judge their level of pain by indicating, from a series of faces, which face represents the intensity of their pain experience. The facial expressions of the faces on the scale become progressively more and more distressed from left to right. The faces on the scales can be photographs (e.g., The Oucher; Beyer, 1984), or cartoon depictions of faces (e.g., Bieri Faces Pain Scale; Bieri, Reeve, Champion, Addicoat, & Ziegler, 1990; Faces Pain Scale – Revised; Hicks, von Baeyer, Spafford, von Korlaar & Goodenough, 2001; the FACES scale; Wong & Baker, 1988). Overall, faces pain scales are the preferred type of self-report measure by children, parents, and nurses (Keck, Gerkensmeyer, Joyce, & Schade, 1996).

There are several factors to consider when selecting a faces pain scale. Research with adult chronic pain patients has shown that scale details, such as number of elements on the scale and end-point, can drastically alter how patients interpret and use rating scales (Williams, Davies, & Chadury, 2000). In regards to faces pain scales used with pediatric populations, scales with cartoon faces are generally preferred because they are thought to remove confounding characteristics such as gender, age, and ethnicity.
(Champion, et al., 1998). An important issue is the facial expression of the anchor face on the left. This face, representing 'no pain,' should not express happiness. A neutral expression is more appropriate and less likely to bias children’s responses by confounding positive emotions and pain (Chambers, Giesbrecht, Craig, Bennett & Huntsman, 1999). Further, it has been suggested that scales with teary-eyed faces at the right end of the spectrum are also to be avoided because boys are thought to be reluctant to select crying faces (Champion et al., 1998).

Within the group of faces pain scales, the Faces Pain Scale – Revised (FPS-R) (Hicks et al., 2001) (see Appendix A) is considered superior to other measures for several reasons. This measure incorporates conventions used by children when drawing faces and represents a continuum of the universal facial reaction to pain. In addition, intervals of difference between the faces have been judged to be equivalent in terms of increasing pain intensity, it has a left anchor face that is neutral in affective expression, and it is sensitive to pain intensity (Champion et al., 1998). The Faces Pain Scale- Revised (Hicks et al., 2001) improves on the original Faces Pain Scale (Bieri et al., 1990) by reducing the total number of faces on the continuum from seven to six to facilitate 0-10 scoring, while retaining the conceptual assets and psychometric advantages of the original scale.

Children’s Use of Self-Report Rating Scales

Although many self-report scales for children have been developed, research indicates that children often experience difficulties appropriately using self-report scales. Young children have been shown to make characteristic errors when using rating scales. For example, they have been shown to rely heavily on the extreme end points of rating scales when they report on general emotional states (Chambers & Johnston, 2002), as
well as pain (von Baeyer, Carlson, & Webb, 1997). Children have also been shown to be swayed by the type of anchor used on a faces pain scale, being biased to make higher pain ratings when the left-most anchor is a smiling face (Chambers & Craig, 1998). Girls have been found to report higher levels of pain on pain scales, regardless of scale type (Chambers et al., 1999; Unruh, 1996).

There is no empirical data charting when and how young children master the challenging task of accurately using self-report scales for pain across early childhood. Based on clinical experience and observation, von Baeyer (2002) estimates that, under optimal testing conditions when an appropriate measure is used with normally developing children who are trained in a 'low pain context,' approximately 30-40% of 3-year-olds, 40-50% of 4-year-olds, 50-60% of 5-year-olds, and 60-70% of 6-year-olds are able to accurately use a self-report scale for pain. Fanurik, Koh, Harrison, Conrad and Tomerlin (1998) found that 100% of the 8-year-olds and 85% of the 7-year-olds included in their sample were able to complete a set of tasks thought to be prerequisites for being able to accurately use a pain scale. Tasks included ordering sets of scale faces and blocks. Only 44% of 6-year-olds and 26% of 5-year-olds completed the precursor tasks with no errors (Fanurik et al., 1998). Similarly, Hunter, McDowell, Hennessy and Cassey (2002), found in their study with children aged 3.5- to 6.5-years, that older children were more accurate than younger children on tasks thought to be precursors for competent use of the Faces Pain Scale (Bieri et al., 1990). Tasks again included ordering scale faces, associating faces with quantities of blocks, and determining which scale face in a pair represented the greater level of pain.
Deficiencies in understanding when and how young children can accurately use self-report scales likely underlies the lack of consensus in the literature regarding what age is appropriate to begin using self-report pain scales with children. Although it is recognized that age is only a rough marker of development, it is a practical way to formulate clinical recommendations. McGrath and Gillespie (2001) suggest that, by 5 years of age, most children can use simple quantitative self-report rating scales. McGrath and Gillespie (2001) also state that some scales may be used with even younger children: they note, for example, that the Faces Pain Scale (Bieri et al., 1990) may be suitable for children as young as 3 years. They support their recommendation by hypothesizing that mapping a subjective pain experience to a face places less cognitive demands on children than other self-report scales because children learn how to interpret facial expression early in infancy (Champion et al., 1998). Other scales require children to map their pain onto an abstract entity (e.g., colour gradient) or require number knowledge to map pain onto a physical entity (e.g., poker chips). In contrast, McGrath (1996) suggests that self-report scales should not be administered until children are at least 7 years old. These conflicting estimates and the lack of data addressing this issue make the development of empirically supported age-appropriate guidelines for pain assessment a challenge. Furthermore, age may be insufficient as a marker of children’s abilities to use self-report scales.

Determining Accuracy on Pediatric Self-report Pain Scales

A major challenge in establishing age-appropriate guidelines for pediatric self-report scales concerns the criterion for knowing whether a child has made an accurate or inaccurate pain rating. Because pain is, by definition, subjective in nature, there are few
empirically derived, clinically relevant methods to test children's use of pain scales. In their study of seriation (the ability to place items in the correct order within a continuum) Shih and von Baeyer (1994) asked children to order the nine faces from a faces pain scale from happiest to saddest. This method of assessing accuracy is removed from the clinical application of pain rating scales, because children were asked to order the scales according to an emotive continuum, rather than pain perception. In a task similarly removed from the clinical setting, McGrath (1990) assessed children's ability to accurately use a VAS by examining whether they were able to characterize the relative size of several circles of varying diameters; children who were within a 0.70 correlation of the actual diameter of the circle were considered accurate and deemed capable of rating pain on a VAS for pain.

Fanurik and colleagues (1998) assessed accuracy by means of nurses' subjective judgements. Nurses indicated 'yes' or 'no' as to whether or not they felt a child would be capable of understanding a numerical scale to rate his or her pain intensity. Nurses significantly overestimated children's ability to use the numerical rating scale. Although this method of determining whether children can accurately use pain scales is derived from a clinical context, it fails to directly assess the child's demonstrated ability to use a pain rating scale. Regrettably, this approach also failed to provide detail regarding the cues nurses used to identify scale-use competency in children.

Vogel (1992) performed a study that determined practice could increase the accuracy of children's use of the Oucher scale (Beyer, 1984). In this study, accuracy was assessed by presenting children with the Charleston Pediatric Pain Pictures (CPPP) (Belter, McIntosh, Finch & Saylor, 1988), a validated group of 17 cartoon pictures
depicting children in situations with one of four levels of pain: 'no pain,' 'low pain,' 'moderate pain,' and 'high pain.' The first set of pictures was a 'calibration subset,' where children rated one picture at each level of pain and established what face would be 'correct' for pictures at the same level of pain in the following sets. Later, an error was scored when a child's rating for a picture deviated from the faces established as 'correct' in the calibration subset. This method of assessing accuracy was appropriate for this study because considering ratings in sets allowed for the effects of training to be examined. However, in clinical settings, accuracy must be determined on the basis of single, rather than multiple, ratings. In addition, it is not ideal to calibrate accuracy levels on a child-by-child basis because young children may not be able to provide accurate calibration levels for themselves. This system also failed to consider that it may be more appropriate to establish what is considered a 'correct' pain-scale rating by comparing ratings to mean scores displayed by a population that is able to accurately use a self-report rating scale.

Without a clinically relevant and feasible method to assess accuracy in children's use of self-report pain scales, it is impossible to document when children are accurately using a self-report pain scale. Hypothetical vignettes show promise as a means of exploring children's use of self-report measures (Vogel, 1992; Chambers & Craig, 1998; Chambers & Johnston, 2002). These methods can be used to chart the development of children's use of self-report pain scales and to determine what factors may foster young children's mastery of these over the course of early childhood.
Answers to questions concerning when and how children are able to accurately use self-report pain scales may lie in examining the developmental factors that relate to children’s understanding of these scales. In keeping with their Sociocommunications Model, Craig et al. (1996) state that a complete understanding of the developmental factors that relate to children’s ability to accurately report on their pain is vital for clinicians who routinely make assessments of procedural pain. Gaffney et al. (2003) hypothesized that, for young children (ages 3- to 6-years-old), the ability to understand rating scale instructions and the ability to quantify dimensional characteristics of continuous quantities are important specific developmental factors to consider. Unfortunately, research has not yet decisively identified which are the key cognitive-developmental factors that play a role in determining young children’s ability to accurately use a self-report pain rating scale. The following discussion will highlight major factors hypothesized to relate to children’s accurate use of a self-report pain scale. These factors are also outlined in Table 1.

**Numerical reasoning.** Two developmental skills related to basic numerical reasoning that may have a part in influencing children’s ability to use self-report scales are seriation and classification (Champion et al., 1998). Seriation involves two abilities, one being the ability to understand the arithmetic concepts of more-than and less-than, and the other being the ability to understand that objects can be ordered in a sequence from least to greatest. Seriation could be related to faces pain scales because the scales involve a series of faces that progress on a continuum from ‘no pain’ to ‘extreme pain’. Research has shown that children demonstrate the precursors to seriation, including an understanding of ‘more’, ‘less’ and ‘the same,’ by age 4 years, but that complete mastery
of seriation is not achieved until 7 years (Blevins & Cooper, 1986). Children younger than 7 years do better on seriation tasks when the number of items they are required to sequence is reduced (Blevins & Cooper, 1986).

Fanurik et al. (1998) investigated the relationship between the ability to seriate and the ability to use a faces pain scale among children ages 4-14 years. Seriation ability was tested through use of tasks illustrating the child’s understanding of the greater-than, less-than concept. Complete mastery of seriation was tested in tasks where children had to order five blocks in a size continuum from smallest to largest and arrange a set of numbered blocks in numerical order. Ability to use a faces pain scale was tested by requiring children to correctly indicate the face that showed ‘no pain’ and then to rate their current level of pain at a level that correlated with nurses’ ratings. Results showed a strong relationship between developmental level (in terms of the ability to seriate) and the ability to report pain on the faces pain scale. Only children 8 years of age and older were able to complete all the seriation tasks and consistently use the faces pain scale. However, only 44% of 6-year-olds, and 25% of 5-year-olds were successful at both the seriation and faces pain scale tasks.

Shih and von Baeyer (1994) also investigated normally developing 3- to 5-year-old children’s ability to perform a basic seriation task and their ability to use a faces pain scale. The seriation task required children to order a set of circles that varied in colour from light to dark. No relation was found between performance on the seriation task and children’s use of the faces pain scale. However, this null result could possibly be attributed to the limited age range of participants in the study which did not permit enough variability to capture a developmental trend. The lack of correspondence
between research by Fanurik et al. (1998) and Shih and von Baeyer (1994) indicates that more research is needed to clarify the relationship between the development of seriation and young children’s ability to use a self-report pain scale.

Classification is the ability to group objects according to shared properties (Bjorklund, 1989). The ability to classify is required in faces pain scales because children need to recognize that faces in the continuum are grouped as a whole based on their common expression of pain or not. The ability to classify develops over childhood. For example, children at 3 years show an inconsistent understanding that physical objects can be grouped according to shared properties (Bjorklund, 1989). By 5 years, children are more consistent, but it is not until age 7 that children are able to reliably classify entities in multi-dimensional groups (Bjorklund, 1989). No known research has been conducted investigating the relationship between children’s ability to classify entities and their ability to use faces pain scales. However, given the potential importance of classification as a fundamental concept in both numerical reasoning and in children’s use of faces pain scales, this is a worthwhile area for future study.

Clearly, more research is needed to investigate the relation of numerical reasoning to children’s ability to use faces pain scales. Future research should build on work conducted by Fanurik et al. (1998) where both general skills using simple shapes and skills specific to the pain rating scale using stimuli from the faces pain scales themselves were tested.

Language. In contrast to numerical reasoning, language development is a factor that has been relatively untouched by empirical study in relation to its role in young children’s ability to accurately use a pain rating scale. A large body of literature
documents how language develops exponentially from birth across early childhood (see Anglin, 1993; Bloom, 1973). However, research has just begun to describe the development of the specific semantic area pertaining to pain.

In late infancy, vocal pain communication skills develop significantly. Pain is still expressed with specific facial expressions, physiological reactions, and physical movements, but language also begins to become a tool (Craig, 1980). The MacArthur Communicative Developmental Inventory (CDI) (Fenson et al., 1993) includes words such as “ouch,” “owie,” “boo-boo,” “cry,” and “hurt” in their comprehension and production battery for children as young as 8 – 15 months, suggesting that these words are present at this time. However, this interpretation should be made cautiously; the inclusion of pain words on the infant battery reflects only the possibility that children may have these words in their vocabulary.

In order to begin to systematically describe children’s pain language, Job, Chambers, Craig, McGrath and Cassidy (2002) studied 5-year-old children receiving a routine pre-kindergarten immunization. Children’s verbalizations immediately following the immunization were coded for the complexity of the type of linguistic utterance produced and the specificity of the utterance to pain. Approximately half of the children used words to communicate pain, and those who used words expressed their pain in simple verbal utterances that were specific to the experience of pain. The modal response was the one-word interjection ‘ow!’ (Job et al., 2002).

Further work by Job, Chambers, Craig and Lee (2003) used the CHILDES database (MacWhinney, 2000), a large transcript database of children speaking across a variety of contexts, to establish when and how often pain words appear in young
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children's spontaneous vocabularies. The study found that the word-stems 'hurt,' 'ouch,' and 'ow' were more frequent and emerged earlier in children's vocabularies than the word-stems 'pain,' 'ache,' 'sore' and 'boo-boo.' Of the children sampled, 'hurt' was the most frequently used word-stem and emerged at 18 months, while 'pain' was used infrequently and emerged at 6 years. Spontaneous use of a pain word was taken to be a demonstration of the child's comprehension of the word's meaning. This research highlights the importance of considering children's language development when assessing pain.

Self-report pain scales demand that children comprehend verbal instructions. For example, the instructions for the Faces Pain Scale - Revised (FPS-R) (Hicks et al., 2001) require children to understand the words "hurt," "a little bit," "more," and "most" while embedded in the context of sentences about facial expressions. Because language is a fundamental component of self-report scales, theorists have postulated that language development plays an important role in determining children's ability to report their pain (Gaffney et al., 2003). McGrath and Gillespie (2001) stated that optimal pain assessment requires that clinicians use language familiar to the individual child being assessed. Marcon and Labee (1990) further emphasized the importance of language development in relation to assessing pediatric headache pain. They posited that if adults assessing pain choose cue words that are developmentally appropriate and personally familiar to individual children, headache assessment would be more comprehensible to children and more interpretable for adults.

Only a few research studies have tested the importance of language development in the pediatric pain assessment process. Bennett-Branson and Craig (1993) studied post-
operative pain in children and found that older children were better able to articulate more conceptually complex and multidimensional descriptions of their pain and were less restricted to sensory words. Despite this finding, Robertson (1993) noted that in the process of validating a multidimensional pediatric pain assessment tool, children between the ages of 7 -11 years consistently confused the words “hurt” and “feeling.” It is important to remember that children’s ability to use a word does not necessarily mean that they have a mature comprehension of its meaning. No studies have considered how language development, in terms of comprehension or production, relates to children’s accuracy on self-report scales.

Further research is needed to investigate the role language development plays in young children’s ability to use self-report scales for pain. Similar to numerical reasoning, it is important to consider a child’s overall level of language development, as well as their level of comprehension within the semantic area of pain.

General cognitive development. While stressing the importance of considering developmental factors, both in general and pain-specific contexts, it is important not to forget that both numerical reasoning and language are in essence specific developmental factors themselves. The most general cognitive developmental factor is an index of a child’s overall cognitive maturity, or overall intellectual development. In fact, Champion et al. (1998) hypothesized that children’s overall level of cognitive maturity is an important developmental factor to consider in relation to children’s ability to use self-report rating scales. No research has investigated the impact of overall cognitive maturity on children’s ability to accurately use self-report pain scales.
Age. While it may be expected that other developmental factors are more specific and relevant, child age could represent an important determinant of children's ability to accurately use a self-report pain scale. Age, although defined as simply the passage of time, can be thought of as a meta-developmental factor that encompasses change in many abilities over time. Child age as an overarching general developmental factor is an important variable to consider in pediatric pain assessment.

Gender. Gender is not a developmental factor. However, a number of studies have found gender differences in children's reports of pain (Chambers et al., 1999; Fowler-Kerry and Lander, 1991; Goodenough et al., 1999; Unruh, 1996). Girls tend to verbally express pain more frequently (Fearon et al., 1996) and rate pain as being more intense than boys (Chambers et al., 1999). Gender is an important variable to consider in research examining self-reports of pain intensity in children.

Purposes and Hypotheses

There were two specific purposes of this study. First, the study described age differences in young children's ability to use self-report pain scales. Second, this study investigated the role of several developmental factors, including numerical reasoning (seriation and classification), language, overall cognitive maturity, and age, in predicting young children's ability to accurately use a self-report pain scale. The study was a cross sectional design with level accuracy on the faces pain scale rating task as the dependent variable, and general level of numerical reasoning (seriation and classification) development, level of numerical reasoning (seriation and classification) specific to a faces pain rating scale, general language development, language development specific to a faces pain scale, overall cognitive maturity, and age as independent variables.
It was predicted that children’s ability to accurately use a self-report pain scale would increase with age. It was also predicted that there would be differences in the relative importance of various developmental factors as they relate to children’s ability to accurately use a pain scale. In particular, the developmental factors related specifically to pain rating scales, such as scale-specific seriation and classification, and pain language, were predicted to play a greater role in children’s ability to accurately use a self-report pain scale than general developmental factors, including general numerical reasoning, general language, overall cognitive development and age.

Methods

Participants

Participants were 106 children recruited from the Lower Mainland of British Columbia using a variety of advertising techniques described below. Children were stratified into four age groups: 3-year-olds (n = 30; 14 male, 16 female); 4-year-olds (n = 28; 14 male, 14 female); 5-year-olds, (n = 28; 14 male, 14 female); and 6-year-olds, (n = 20; 10 male, 10 female). These age groups were chosen to reflect the range at which there are conflicting reports regarding the youngest age at which one can successfully use a self-report pain scale with children. This sample size was chosen to obtain levels of power 0.80 or greater with alpha set at 0.05 (one-tailed). This allowed for large effect sizes, traditionally 0.40, to be detected in all analysis of variance (ANOVA) calculations, and moderate effect sizes, traditionally 0.15, to be detected in all regression calculations (Cohen, 1988).

Once contact had been established with the family, a telephone screening was conducted with parents to determine if a child was eligible for the study. Children were
included if they were not experiencing any chronic illness or chronic medical condition that affected how they felt on a daily basis, they were not suspected or known to have a developmental delay, and they were fluent in English. Parents were also required to be fluent in English. This study was approved by the University of British Columbia Behavioural Research Ethics Board and the Children’s and Women’s Health Centre of British Columbia’s Research Review Committee. Parents provided written informed consent and children provided verbal assent.

The families who participated in the study represented a range of ethnicities and socioeconomic status levels. The three most common self-identified ethnic groups represented in the sample were Caucasian (n = 77; 73%), Chinese (n = 14; 13%), and South/West Asian (n = 10; 10%). The majority of families reported a yearly household income level of greater than $80,000 (n = 50; 47%). The remaining families reported yearly household income of $60,000-$79,000 (n = 19; 18%), $40,000-$59,000 (n = 16; 15%), or $20,000-$39,000 (n = 14; 13%).

Procedure

Advertisements for the study were placed in family magazines, such as B.C. Parent Magazine, and newspapers, such as The Courier and The Vancouver Sun. Advertisements also were posted on bulletin boards at community centres, schools, and libraries in Vancouver, Burnaby, North Vancouver, West Vancouver, and Surrey. Interested parents were instructed to call our research centre for more information. Of the 168 parents who contacted the centre desiring information about the study, 58 parents chose not to participate. Reasons for not participating included not being interested after hearing study details (n = 29; 50%), not being fluent in English (n = 10; 17%), having a
chronic medical illness (n = 7; 12%), having a developmental delay (n = 5; 9%),
experiencing an unexpected family illness (n = 5; 9%), and not having a child within the
desired age group (n = 2; 3%; child age = < 3 years). Only 4 children (three 3-year-olds
and one 4-year-old) who began participation in the study were unable to complete all the
tasks and were excluded from analyses.

After interested parents had contacted our centre, parents were informed of the
purpose of the study and were screened for eligibility. Participating families were
scheduled to visit our research centre at B.C.'s Children's Hospital with their child for a
90-minute appointment. Once at the centre, the child was able to orient to the new
environment and play with toys while informed consent was obtained from the parent.
Children then provided verbal assent to participate in the study. Testing took place in a
small room with a desk and a chair at one end, and a table with two small chairs at the
other. Parents sat at the desk, quietly completed a family demographic questionnaire, and
read magazines. Children sat at the table with the researcher and were tested on a series
of tasks. Parents were instructed not to provide any assistance to their child during the
tasks. The tasks were organized into three counterbalanced blocks. Tasks within a block
were undertaken in a set order to maintain the psychometric integrity of validated
measures. Table 2 shows the counterbalancing matrix for the tasks. Detailed
descriptions of all tasks are described in the Measures section.

To measure children's ability to use a self-report pain scale, children completed a
pain scale accuracy task using the Charleston Pediatric Pain Pictures (CPPP; Belter et al.,
1998), and the Faces Pain Scale Revised (FPS-R; Hicks et al., 2001).
Developmental factors were measured by several tasks. Numerical reasoning development was assessed using classification and seriation tasks. General abilities were tested in tasks using square cards and abilities specific to pain scales were assessed using cards with faces from the FPS-R (Hicks et al., 2001). Language development was tested in two tasks. General language development was tested using the Peabody Picture Vocabulary Test, 3rd Edition, Form A (Dunn & Dunn, 1997). Development of language specific to pain scales was tested using the ‘high pain’ pictures from the CPPP (Belter et al., 1998) and a modified version of the standard CPPP script (Belter et al., 1998). Overall cognitive maturity was assessed using a validated short-form of the Weschler Preschool and Primary Scale of Intelligence-Revised (Weschler, 1989) that included the Block Design, Arithmetic, and Vocabulary subtests.

In between tasks, the children were encouraged to take short breaks to go to the bathroom, get a drink, or get up and do something active for a few minutes. Stickers were used as reinforcers throughout the session, as appropriate. Once the session was complete, children received a t-shirt, a certificate and a small toy (value $1) to acknowledge their participation. Parents received $5.00 to help with parking and transportation costs.

Three trained research assistants tested the 106 children who participated. Tester 1 worked with 71 families, Tester 2 with 18 families, and Tester 3 with 17 families. All data were entered into an SPSS Version 11 database. A random sample of 20% of the data was checked for entry errors by a trained researcher.

Measures
The Charleston Pediatric Pain Pictures (pain scale accuracy task). The Charleston Pediatric Pain Pictures (CPPP) (Belter et al., 1988) are a group of 17 cartoon pictures of a child in situations where no pain, a small amount of pain, a moderate amount of pain, or a great deal of pain could be expected to result. The child in the pictures is non-descript in terms of gender, age, and ethnicity. The standard script was followed. The standard instructions to the FPS-R (Hicks et al., 2001) were embedded within this introduction script. Children were asked to pretend that they were the child in the picture and to indicate the amount of pain they thought they would feel using the FPS-R (Hicks et al., 2001). The validated picture presentation order was followed (See Appendix B for script and Appendix C for sample pictures).

The CPPP has been shown to have convergent levels of validity with other validated self-report scales (Belter et al., 1988). Test-retest reliability for individual items supported scoring the measure using a composite score that combined individual ratings (Belter et al., 1988). Earlier studies that tested children aged 7- to 12-years, showed that older children could easily discriminate the four levels of pain depicted in the pictures (Belter et al., 1988).

Faces-Pain Scale Revised (rating scale accuracy task). The Faces Pain Scale Revised (FPS-R; Hicks et al., 2001) is a six-face scale with a neutral left anchor face. Each face in the FPS-R corresponds to a code, ranging from 0 to 5, indicating the intensity of pain the face represents (see Appendix A). A faces pain scale was selected because of recommendations in the literature for their use with young children (McGrath & Gillespie, 2001). As discussed earlier, the FPS-R (Hicks et al., 2001) is considered to be the most psychometrically superior faces pain scale for young children. It has a
neutral anchor face, no faces with tears, and requires children to choose from a relatively low number of faces. Validity of the FPS-R has been demonstrated through strong positive correlations with another faces pain scale ($r = 0.93$), a visual analogue scale ($r = 0.92$), and a colour analogue scale ($r = 0.84$) among samples of healthy children and children experiencing procedural pain (Hicks et al., 2001).

**Accuracy score (rating scale accuracy task).** An individual picture error score was calculated for each CPPP picture by considering the category of pain represented by the picture. For example, if the child was shown a picture in the 'low pain' group, they could point to the 1, 2, or 3 faces on the FPS-R and be scored as 'correct.' If the child pointed to the 0, 4, or 5 faces, they would be scored for making an 'error.' A child's total error score was calculated by summing the 17 individual picture errors scores. See Table 3 for a tabular depiction of the picture scoring scheme. The individual picture scoring scheme was developed by considering the average scores of 7- to 10- year-olds for each of the pain categories (Belter et al., 1988). The average scores for the 7- to 10-year-old children, who were thought to have complete mastery of the FPS-R task, fell within the range scored 'correct' on the coding scheme designed for this study. This scoring scheme was designed to improve on Vogel's system (1992) where 'correct' and 'error' scores were determined on a child-by-child basis by considering scores within subsets of pictures in the group.

**Classification tasks.** The task testing general classification ability involved the use of three red, three yellow, and three blue 1.5 inch square cards. The script used was the original script used by Piaget in his tests of classification ability (Piaget, 1941/1952). Cards were placed on the table in front of the child in a random arrangement and children
were told to "put together the things that are alike." Children were assigned a score ranging from 0 to 3 based on the number of three-card, same-colour groups they were able to produce.

The task testing classification ability specific to a self-report rating pain scale involved use of nine white 1.5 inch square cards. Three cards in the set represented the FPS-R neutral anchor face, three cards in the set represented the FPS-R 3-point face, and three cards represented the FPS-R 5-point face (see Appendix A for faces used). These faces were chosen because they represented the two anchor faces and a mid-point face on the FPS-R (Hicks et al., 2001) and were thought to be the three faces from the scale that would be the easiest to distinguish from one another other in a classification task. The task was administered with the same method and script as the square task. Children were assigned a score ranging from 0 to 3 based on the number of three-card, same-face groups they were able to produce.

Seriation tasks. The task testing general seriation ability involved use of six red square cards that progressed in size from 1.5 inches square to 4.0 inches square, at half-inch intervals. The cards were placed in a predetermined random linear order on the table in front of the child and children were told, "now, try and put first the smallest, then one that is a little bit bigger, then another that is a little bit bigger, and so on." The task utilized the original script used by Piaget in his tests of seriation ability (Piaget, 1955/1964). Children were assigned a score ranging from 0 to 6 based on the number of square cards they put in the correct order within the size continuum.

The task testing seriation ability specific to a self-report pain scale involved use of six 1.5 inch square cards, each with one of the faces from the FPS-R (Hicks et al., 2001)
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(see Appendix A for faces). The administration method and script were the same as those used in the seriation squares task. Children were assigned a score ranging from 0 to 6 based on the number of face cards they put in the correct order of faces on the FPS-R (Hicks et al., 2001).

**Peabody Picture Vocabulary Test, 3rd Edition, Form A (general language development task).** The Peabody Picture Vocabulary Test, 3rd Edition (PPVT-3) (Dunn & Dunn, 1997) is a standardized, well-validated measure of children's receptive language ability (Sattler & Hildebrand, 2001). The measure does not assess all aspects of language development, such as expressive language, it was chosen because of its strong psychometric properties. Construct validity has been demonstrated for the measure by increases in mean raw scores with age, with dramatic increases across child populations and only gradual changes across adult populations. The measure shows satisfactory levels of concurrent validity with the Oral and Written Language Scales (Carrow-Woolfolk, 1995) (Median $r = 0.73$), as well as the Weschler Intelligence Scale for Children, 3rd Edition (Weschler, 1991) (Median $r = 0.85$). The standard administration protocol was followed and Form A of the PPVT-3 was used. Children listened to words and pointed to the picture that best described the word. Children's total raw scores were converted into standard scores based on validated age-norms.

**Pain Language.** Children were shown the four 'high pain' pictures of the CPPP (Belter et al., 2001). Pain language was solicited using a modified version of the standard CPPP script (Belter et al., 2001). Children were asked to respond to the cue "you say..." at the end of the script for each picture. Children were trained to respond to the
Pain language development was quantified using a coding scheme adapted by Job et al. (2002) from the method of coding verbalizations used in the CHEOPS (McGrath et al., 1985). The CHEOPS is a well-validated observational rating tool that codes pain behaviours in a number of domains, including verbalization (McGrath et al., 1985). Development was judged on children’s ability to provide a verbalization specific to the experience of pain. Specificity to pain was measured on a 0 to 3 scale, where verbalizations expressing positive emotion were coded as a 0, a lack of verbalization was coded as a 1, verbalizations that expressed negative affect but were not specific to pain were coded as a 2, and verbalizations that expressed negative affect and were specific to pain were coded as a 3. To establish the reliability of the coder, a 20% random sample of verbalizations were independently coded by another trained coder. There were very few disagreements between coders (< 10 verbalizations out of 424 total) and all disagreements were settled through discussion.

Validated short-form of the Weschler Preschool and Primary Scale of Intelligence- Revised (overall cognitive maturity task). The Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R) (Weschler, 1989) is a standardized assessment tool designed to measure cognitive ability in children aged 3-years-0-months to 7-years-3-months. It is composed of twelve subtests assessing different intellectual tasks. Standardized subtest scores are compiled to generate a Full Scale IQ score. The WPPSI-R (Weschler, 1989) was standardized on a sample of 1,700 children and has been shown to have excellent internal and test-retest reliability. Concurrent validity studies
show an average correlation of $r = 0.74$ with scores on other intelligence tests (Sattler & Hildebrand, 2001). Factor analysis also supports subtest structure (Sattler & Hildebrand, 2001).

The short-form of the WPPSI-R (Wechsler, 1989), consisting of the Block Design, Arithmetic and Vocabulary subtests, is a validated short-form of the full intelligence test (Sattler & Hildebrand, 2001). Short-forms of intelligence tests are often utilized in research because they take less time to administer but have high internal reliability and high concurrent validity when compared to the complete version of the measure (Sattler & Hildebrand, 2001). This short form has excellent internal reliability ($r = 0.91$) and a strong correlation with the standard form of the WPPSI-R ($r = 0.88$; Sattler & Hildebrand, 2001).

Children were administered the subtests in the standard order. All standardized administration procedures were followed. The Block Design subtest requires children to reproduce up to 14 geometric designs using 2 or 4 coloured tiles. This subtest assesses children’s visual-spatial skills and fine motor ability. The Arithmetic subtest requires children to communicate their mastery of basic numerical concepts. Items assess children’s understanding of greater-than, less-than concepts, counting ability, and mastery of basic mathematical operations. On the Vocabulary subtest, children are asked to verbally articulate the meaning of objects or actions.

For each subtest, children’s raw scores were converted into standard scores based on validated age-norms. As the scoring of the Vocabulary subtest required some subjective judgement, a random sample of 20% of the children’s responses were
reviewed by a registered psychologist. There were no disagreements in scores. To create an overall score, the standard scores for the subtests were summed.

Data Analyses

Children's development of accuracy on the self-report pain scale. The means and standard deviations of children's error scores on the pain scale accuracy task were calculated for each of the four age groups included in the study. To test the hypothesis that older children would be more accurate at using the self-report scale, a one-way ANOVA was conducted, with children's age in years as the independent variable, and children's total error scores as the dependent variable. Post-hoc testing, using a Student-Newman-Keuls analysis, was performed to determine specific age group differences. A set of one-sample t-tests were conducted to determine whether mean error scores for each age group differed significantly from scores that would be expected based on chance. To determine chance levels of responding, the number of options a child could choose on the FPS-R (Hicks et al., 2001) and receive an 'error' score was calculated for each CPPP picture (Belter et al., 1988). For example, for the 'low pain' pictures, a child could chose 3 of the 6 faces (the 0, 4, or 5 face) and receive an 'error' score. A ratio was created for each picture by dividing the chance of getting an 'error' by 6 (the total number of faces on the FPS-R). The ratios were summed to determine a total chance ratio. This ratio was multiplied by 17 (the total number of CPPP pictures) and divided by 100 to determine a chance error score. Using this method, the error score expected from random responding was calculated to be 10.49 out of 17.

Determining the developmental factors that predict children's accuracy on the self-report pain scale. Means and standard deviations of children's scores on all the
developmental factors and their score on the pain scale accuracy task were calculated. Correlations among these variables were calculated and the correlation matrix was inspected for co-linearity. Prior to performing the hierarchical regression, data was examined for outliers. There were no univariate outliers jeopardizing the data. Distance, leverage, and influence type multivariate outliers were considered (Tabachnick & Fidell, 1996). No subject had scores that were greater than two standard deviation points beyond the mean in more than one realm. Thus, no data were removed from the sample on the basis of being a multivariate outlier. A hierarchical regression analysis was conducted with children’s error scores on the pain scale accuracy task as the dependent factor. Child age (in months) and child gender were entered in the first block of independent variables and scores on the developmental factors were entered in the second block. The variables entered in the second block were scores on the squares classification task, the faces classification task, the squares seriation task, the faces seriation task, and the pain language development task. Children’s standard scores on the WPPSI-R and the PPVT-3 were also entered in this block.

Results

Children’s Accuracy on the Self-Report Pain Scale

Descriptive analysis. The means and standard deviations of children’s error scores on the pain-scale accuracy task by age (in years) are shown in Table 4. This information is also presented graphically in Figure 2. To aid with interpretation, translated into percentages, the mean percentage of errors made by children in each of the four age groups on the pain scale accuracy task was as follows: 60.78% for 3-year-olds, 49.37% for 4-year-olds, 38.02% for 5-year-olds, and 39.12% for 6-year-olds.
Inferential analyses. The results of the one-way ANOVA examining the effect of child age on pain scale accuracy showed a significant main effect for age in years, $F(3,102) = 19.59, p < 0.001$, [effect size ($\eta^2$) = 0.37]. Post hoc testing using the Student-Newman-Keuls analysis showed that 3-year-olds were significantly less accurate (had more errors) than 4-year-olds, and that 4-year-olds were significantly less accurate (had more errors) than 5- and 6-year-olds. The latter two groups did not differ significantly from each other.

A series of one-way t-tests comparing obtained error scores to the score that would be expected given chance responding (10.49) revealed that the 3-year-olds performed no better than would be expected by chance, $t(29) = -0.44, p = 0.66$.

However, as shown in Figure 2, the 4-, 5-, and 6-year-olds each performed significantly better on the pain scale accuracy task than would be expected by chance (4-year-olds: $t(27) = -5.86, p < 0.001$; 5-year-olds: $t(27) = -8.01, p < 0.001$; 6-year-olds: $t(19) = -9.04, p < 0.001$).

Determining the Developmental Factors that Predict Children’s Accuracy on the Self-Report Pain Scale

Descriptive analysis. The means and standard deviations of children’s scores on the various developmental tasks and children’s error score on the pain scale accuracy task are shown in Table 4. The Pearson $r$ correlation matrix of these variables is shown in Table 5. Inspection of the correlation matrix revealed that error scores were significantly related to all of the developmental factors tested with the exception of children’s standard scores on the WPPSI-R and the PPVT-3. Similarly, with the exception of WPPSI-R and PPVT-3 scores, age was significantly correlated with all of the developmental factors.
Regression Analyses. As age was found to be significantly correlated with most of the developmental factors tested, it was entered in the first stage of the regression. Gender was also entered in the first stage of the regression in order to control for any potential predictive variance that could be attributed to this variable. All other developmental factors were entered in the second stage of the regression.

The results of the hierarchical multiple regression showed that the full model was significant at both stages, but only the first step encompassed significant predictive variance, Adjusted $R^2$ stage 1 = 0.322, $F(2,103) = 25.96$, $p < 0.001$; Adjusted $R^2$ stage 2 = 0.312, $F(6, 97) = 0.77$, $p = 0.61$. Table 6 shows beta weights for the predictor variables.

Children’s age (in months) was the only significant predictor of children’s self-report pain scale error scores. The amount of variance accounted for by age could be estimated using the Adjusted $R^2$ of the first stage of the model, because age was the only predictive factor of the two variables entered. Thus, age accounted for approximately 32.20% of the variance in children’s error scores on the pain scale accuracy task. None of the other developmental factors, including either scores for general developmental factors (Classification – Squares, Seriation – Squares, PPVT-3, or WPPSI-R) or developmental factors specific to the self-report pain scale (Classification – Faces, Seriation – Faces, Pain Language) made significant contributions in predicting pain scale accuracy beyond the explanatory contribution made by the child’s age.

Because the hierarchical regression considered both child age and gender in the first stage, the Adjusted $R^2$ value obtained included the predictive contributions of both these variables combined. Gender was not found to be a significant predictor of
children’s accuracy. To calculate a variance value for the effects of age alone, a second regression analysis was conducted. Again, age was found to be a significant predictor of children’s pain scale accuracy, with age accounting for 32.90% of the variance in children’s error scores on the pain scale accuracy task, Adjusted $R^2 = 0.329$, $F(1,104) = 52.41, p < 0.001$.

Discussion

The current study compared the abilities of 3- to 6-year-old children to use a self-report scale for pain. The study also investigated the role of developmental factors, both general factors and factors specific to a pain scale, in predicting children’s self-report pain scale accuracy.

Young Children’s Use of Self-Report Pain Scales

The results of the study supported the first hypothesis regarding young children’s use of self-report measures for pain. Older children were more accurate in their use of the self-report pain scale than younger children. Specifically, 5- and 6-year-olds were significantly more accurate on the pain scale accuracy task than 4-year-olds, who in turn were significantly more accurate than 3-year-olds. It is noted, however, that the percentage of errors made by children ranged from approximately 60% among the 3-year-olds to 40% among the 6-year-olds, indicating that even the oldest children in this study experienced difficulties using the self-report pain scale accurately. The 3-year-olds performed no better than would be expected by chance. It is important to note that these findings may represent an overestimation of young children’s abilities to use self-report scales for pain, given the sample’s healthy status and relatively privileged socioeconomic status.
Early childhood is a time of rapid learning and improvement in many developmental domains. However, the capabilities displayed by children in this study were lower than expected, particularly given the age-related guidelines for using self-report scales in the literature. These findings are most consistent with estimates provided by von Baeyer (2002), who speculated that 30-40% of 3-year-olds and 60-70% of 6-year olds can accurately use self-report scales for pain. The results of the current study do not support the recommendation of McGrath and Gillespie (2001) who propose that several types of scales, including faces pain scales, are appropriate for children as young as 3 years of age. Fanurik and colleagues (1998) found that nurses tend to overestimate children's abilities to accurately use a self-report scale. It is possible that many of the recommendations provided by health professionals regarding the age at which certain self-report scales are appropriate for use with children represent overestimates of when children are actually able to use these measures. Indeed, many adults and well-meaning health professionals may not sufficiently appreciate the conceptual complexity underlying a measure that appears to involve only pointing on the part of a young child.

**Developmental Factors and Accuracy on the Self-Report Pain Scale**

The study also examined the second hypothesis regarding developmental factors and their relation to children's accuracy on self-report pain scales. The results of this study did not support the proposed hypothesis. Developmental factors that were specific to the experience of pain, such as classification with pain scale faces, seriation with pain scale faces, and pain language development, were not better predictors of children's pain scale accuracy than general developmental factors, such as age, overall cognitive maturity, general classification with squares, general seriation with squares, and general
language development. In fact, the only developmental factor that contributed significantly to pain scale accuracy was age.

These results could be explained by the fact that age, or the passage of time, is implicit in the definition of a developmental factor. Developmental factors are domains that grow and mature over time. As a result, it should not be surprising that there were significant correlations between age and the other developmental factors, whose scores were not standardized, or pre-corrected for the effects of age. The significant correlations between age and the developmental factors can be used to help understand why age is the best predictor of children's accuracy scores. Almost all of the predictors were found to be related to both children's age and accuracy scores. However, no predictors had the ability to show that they were more important to accuracy than age. Age can be understood to be a meta-developmental index that encompasses child development across all possible factor domains, including both the factors tested in this study, as well as those not explicitly tested in this study. Consistent with the findings of Shih and von Baeyer (1994) the findings of the current study appear to indicate that age, rather than specific developmental abilities, best predicts children's use of self-report scales.

Implications

The results of this study have important implications for the study of pediatric pain. Overall, the study highlights the importance and complexity of the pain assessment component of the Sociocommunications Model of pediatric pain (Craig et al., 1996; Craig, 2002). The finding that even 6-year-olds make errors 40% of the time when using the FPS-R (Hicks et al., 2001) raises serious questions about the use of self-report scales in clinical practice with young children. The FPS-R is considered to be one of the most
psychometrically sound scales available and is reported to be one of the best scales to use with young children (McGrath & Gillespie, 2001). It is concerning that the young children included in our study made so many errors when using this sound, psychometric tool. If young children provide inaccurate reports of their pain, and these reports are judged to be credible by caregivers, the pain assessment process is jeopardized, making young children vulnerable to improper pain management initiatives.

The findings of this study also shed light on the role of developmental factors in predicting children’s ability to accurately use pain scales. Age was the only developmental factor shown to be a unique predictor of accuracy. This indicates that evidence-based recommendations for pain assessment can be made on the basis of child age, rather than on the other factors assessed in this study. Regardless, many of the other developmental factors tested in this study were shown to correlate significantly with children’s accuracy scores. This provides important information about a set of skills that could form the basis for training protocols to teach children how to become more accurate users of self-report pain scales.

Limitations and Future Research

There were several limitations of this study, all of which need to be addressed in future research. First, this study investigated children’s ability to accurately use a self-report pain scale in response to hypothetical cartoon vignettes (Belter, 1989). Although this was thought to be a valid laboratory-based method that allowed for controlled assessment, it is necessary to determine children’s accuracy levels when using a self-report pain scale in response to a clinical pain stimulus. It is possible that the accuracy task developed in this study could be used as a screening tool to determine accuracy prior
to a child using a scale in a clinical context. The next challenging step would involve the examination of whether children's responses on the accuracy task used in this study predict their appropriate use of self-report measures when rating clinical pain. This could be accomplished by examining the correlation of children's pain ratings in response to a real pain stimulus, such as an injection or a blood test, with an objective measure of the child's pain response, such as the CHEOPS (McGrath et al., 1985).

Second, this study tested children's ability to accurately use one type of self-report scale: the FPS-R (Hicks et al., 2001). Although this scale was chosen because it is a psychometrically sound scale recommended for use with young children, there are many other types of scales commonly used with preschoolers, such as the Poker Chip Tool (Hester, Foster, & Kristensen, 1990) and the Oucher (Beyer, 1984). Future research should demonstrate children's relative accuracy levels on the other types of scales commonly recommended for use with young children. It is possible that young children may find certain types of scales to be easier or more difficult to use than the FPS-R (Hicks et al., 2001).

Another important direction for future research is the examination of older children's use of self-report pain scales. The results of this study showed that even 6-year-olds made errors nearly 40% of the time when using the self-report pain scale. As a result, the study's sample did not document the full developmental continuum of children's use of the self-report pain scale beyond the age of 6 years. It is possible that the tendency of health professionals to overestimate children's ability to accurately use self-report scales for pain could extend to older children as well.
The results of this study also leave behind a lingering question to be answered: Aside from age, what other variables contribute to children's accuracy on self-report scales? In this study, age was found to account for 33% of the variance associated with children's accuracy scores. This leaves roughly 67% of the predictive variance unexplained. Future research should attempt to uncover these variables. It is possible that other important predictors will be developmental factors not tested in this study, for example, memory or previous pain experience. Children with more sophisticated memory skills and attention spans may be better equipped to provide accurate self-reports of pain. Previous pain experience may foster children's awareness of pain, making children with greater experience with pain more accurate self-reporters of pain. The current study examined cognitive-developmental predictors of young children's use of self-report scales for pain. Perhaps social-developmental factors, such as attachment or temperament, may play important roles in contributing to children's use of these measures. Regardless, an uncovered developmental factor would have to show predictive capability beyond age, which none of the developmental factors examined in the current study were able to do.

Alternatively, the remaining predictive variance may be explained by a factor not related to development. These types of non-developmental factors would have to be child or family characteristics that remain stable over childhood. Possible factors to consider may be child pain sensitivity or family socioeconomic status (Chen, Craske, Katz, Schwartz, & Zeltzer, 2000 & Chen, Matthews, & Boyce, 2002). Pain sensitivity may permit children with higher pain sensitivities to be more in-tune with the concept of a pain continuum, which may in turn permit more accurate self-reports of pain (Chen
Future research should be directed toward the development of screening and training tasks that caregivers can implement in order to optimize children's use of self-report pain scales. Screening tasks completed prior to pain assessment with a self-report scale could be completed to determine whether the child is capable of making accurate pain ratings using the scale. The results of the current study point to using explicit consideration of a child's age as a preliminary screening test. It is also possible that the pain accuracy task used in the current study could be further developed into a screening task for use in clinical settings. Future research is needed to identify additional variables that could be used to create and validate effective screening procedures for pediatric pain assessment. Research is also needed to examine whether training tasks can be used to teach young children how to accurately use a self-report scale for pain. For example, a conceivable training task could involve teaching young children how to put the faces from the FPS-R (Hicks et al., 2001) in order to examine whether this aids in their accurate use of the measure. It is not yet clear whether a training experience can accelerate children's development of accuracy on self-report pain scales. Initial research by Vogel (1992) indicates that improvements in children's use of self-report pain scales are possible after a single session of teaching and practice.

Conclusion

The results of this study indicate that, although older children are more accurate at using a self-report pain scale, even 5- and 6-year-olds have difficulty accurately using such scales. There appears to be a general tendency for researchers and clinicians in
pediatric pain to overestimate young children’s ability to accurately use self-report scales for pain. Although children’s ability to accurately use a self-report scale for pain correlated significantly with many developmental factors, age was found to be the only developmental factor that uniquely predicted children’s use of the scale. This study highlights the importance of using research to provide the basis for recommendations regarding pediatric pain assessment and provides valuable information that could be used to improve pain assessment in young children.
References


Table 1.

Developmental Factors Thought to Relate to Children's Accurate Use of a Self-Report Pain Scale

<table>
<thead>
<tr>
<th>Developmental Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Numerical Reasoning Development</td>
</tr>
<tr>
<td>a. Seriation Development</td>
</tr>
<tr>
<td>i. General</td>
</tr>
<tr>
<td>ii. In Relation to a Pain Scale</td>
</tr>
<tr>
<td>b. Classification Development</td>
</tr>
<tr>
<td>i. General</td>
</tr>
<tr>
<td>ii. In Relation to a Pain Scale</td>
</tr>
<tr>
<td>2. Language Development</td>
</tr>
<tr>
<td>i. General</td>
</tr>
<tr>
<td>ii. In Relation to a Pain Scale</td>
</tr>
<tr>
<td>3. General Cognitive Development</td>
</tr>
<tr>
<td>4. Age</td>
</tr>
</tbody>
</table>
Table 2.

**Counterbalanced Blocks of Tasks**

<table>
<thead>
<tr>
<th>Block</th>
<th>Skill Tested</th>
<th>Task</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Classification</td>
<td>Classification Blocks</td>
<td>Colour Blocks</td>
</tr>
<tr>
<td></td>
<td>a. General</td>
<td>Classification Faces</td>
<td>Faces from the FPS-R</td>
</tr>
<tr>
<td></td>
<td>b. Pain Scale Specific</td>
<td>Classification Blocks</td>
<td>Size Blocks</td>
</tr>
<tr>
<td></td>
<td>Seriation</td>
<td>Classification Faces</td>
<td>Faces from the FPS-R</td>
</tr>
<tr>
<td></td>
<td>a. General</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Pain Scale Specific</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pain Scale Accuracy</td>
<td>Pain Rating Task</td>
<td>CPPP, FPR-R</td>
</tr>
<tr>
<td></td>
<td>Pain Language</td>
<td>Pain Language Task</td>
<td>‘High Pain’ CPPP pictures.</td>
</tr>
</tbody>
</table>

| B.    | Cognitive Maturity          | Intelligence Task           | WPPSI-R Short Form                           |
|       |                              |                             | Block Design subtest                          |
|       |                              |                             | Arithmetic subtest                            |
|       |                              |                             | Vocabulary subtest                            |

| C.    | General Language            | Language Task               | PPVT-3                                        |

*Note. Letters represent counterbalanced elements. Elements not lettered were administered in the order displayed. FPS-R = Faces Pain Scale – Revised (Hicks et al., 2001); CPPP = Charleston Pediatric Pain Pictures (Belter, 1988); WPPSI-R = Weschler Preschool and Primary Scale of Intelligence Revised (Weschler, 1989); PPVT-3 = the Peabody Picture Vocabulary Test, 3rd Edition (Dunn & Dunn, 1997).*
Table 3.

**Individual Picture Error Scoring Scheme for the Pain Scale Accuracy Task**

<table>
<thead>
<tr>
<th>CPPP Pain Category</th>
<th>FPS-R 'Error' Face(s)</th>
<th>FPS-R 'Correct' Face(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>No Pain (4/17)</td>
<td>X X X X X</td>
<td>✓</td>
</tr>
<tr>
<td>Low Pain (4/17)</td>
<td>X X X X X</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Moderate Pain (5/17)</td>
<td>X X X</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>High Pain (4/17)</td>
<td>X X X X X</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

*Note.* (X) = faces within a CPPP pain category that would receive an 'error' score of 1; (✓) = faces within a CPPP pain category that would receive a 'correct' score of 0. Ratios in brackets after CPPP pain categories indicate the number of pictures in that category within the entire 17-picture set.
Table 4.

Means and Standard Deviations for Developmental Factor Scores and Pain Scale Error

Scores by Children’s Age in Years

<table>
<thead>
<tr>
<th>Measure</th>
<th>Age in Years</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(36 - 48)</td>
<td></td>
<td>M=41.97</td>
<td>M=53.96</td>
<td>M=62.25</td>
<td>M=78.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD=3.37</td>
<td>SD=3.85</td>
<td>SD=3.06</td>
<td>SD=3.67</td>
</tr>
<tr>
<td>Classification – Squares</td>
<td></td>
<td>M=1.87</td>
<td>M=2.75</td>
<td>M=2.89</td>
<td>M=2.90</td>
</tr>
<tr>
<td>(0 - 3)</td>
<td></td>
<td>SD=1.43</td>
<td>SD=0.80</td>
<td>SD=0.57</td>
<td>SD=0.48</td>
</tr>
<tr>
<td>Classification – Faces</td>
<td></td>
<td>M=1.40</td>
<td>M=2.39</td>
<td>M=2.75</td>
<td>M=2.90</td>
</tr>
<tr>
<td>(0 - 3)</td>
<td></td>
<td>SD=1.38</td>
<td>SD=1.20</td>
<td>SD=0.75</td>
<td>SD=0.48</td>
</tr>
<tr>
<td>Seriation – Squares</td>
<td></td>
<td>M=1.40</td>
<td>M=3.07</td>
<td>M=5.07</td>
<td>M=5.45</td>
</tr>
<tr>
<td>(0 - 6)</td>
<td></td>
<td>SD=1.38</td>
<td>SD=2.36</td>
<td>SD=1.82</td>
<td>SD=1.70</td>
</tr>
<tr>
<td>Seriation – Faces</td>
<td></td>
<td>M=0.93</td>
<td>M=2.04</td>
<td>M=3.71</td>
<td>M=4.85</td>
</tr>
<tr>
<td>(0 - 6)</td>
<td></td>
<td>SD=0.64</td>
<td>SD=1.64</td>
<td>SD=1.86</td>
<td>SD=1.76</td>
</tr>
<tr>
<td>PPVT-3 (Standard Score)</td>
<td></td>
<td>M=108.27</td>
<td>M=117.96</td>
<td>M=116.07</td>
<td>M=110.20</td>
</tr>
<tr>
<td>(0 – 160)</td>
<td></td>
<td>SD=16.78</td>
<td>SD=10.95</td>
<td>SD=16.61</td>
<td>SD=113.11</td>
</tr>
<tr>
<td>Pain Language</td>
<td></td>
<td>M=9.13</td>
<td>M=10.79</td>
<td>M=11.21</td>
<td>M=10.65</td>
</tr>
<tr>
<td>(0 – 12)</td>
<td></td>
<td>SD=3.15</td>
<td>SD=1.81</td>
<td>SD=1.47</td>
<td>SD=1.46</td>
</tr>
<tr>
<td>WPPSI-R (Standard Score)</td>
<td></td>
<td>M=35.43</td>
<td>M=32.29</td>
<td>M=38.57</td>
<td>M=34.85</td>
</tr>
<tr>
<td>(3 – 57)</td>
<td></td>
<td>SD=5.47</td>
<td>SD=6.65</td>
<td>SD=6.10</td>
<td>SD=5.47</td>
</tr>
<tr>
<td>Pain Scale Error</td>
<td></td>
<td>M=10.33</td>
<td>M=8.39</td>
<td>M=6.46</td>
<td>M=6.65</td>
</tr>
<tr>
<td>(0 – 17)</td>
<td></td>
<td>SD=1.95</td>
<td>SD=1.89</td>
<td>SD=2.66</td>
<td>SD=1.90</td>
</tr>
</tbody>
</table>

Note. Numbers in brackets below each measure are the range of possible scores for that measure.
Table 5.

Correlation Matrix for Developmental Factor Scores and Pain Scale Error Scores

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Mo.</td>
<td>1.00</td>
<td>0.39**</td>
<td>0.48**</td>
<td>0.68**</td>
<td>0.74**</td>
<td>0.05</td>
<td>0.26**</td>
<td>0.07</td>
<td>-0.58**</td>
</tr>
<tr>
<td>Class. Sq.</td>
<td>1.00</td>
<td>0.65**</td>
<td>0.22*</td>
<td>0.32**</td>
<td>0.11</td>
<td>0.26**</td>
<td>0.21*</td>
<td>-0.23*</td>
<td></td>
</tr>
<tr>
<td>Class. Fs.</td>
<td>1.00</td>
<td>0.30**</td>
<td>0.37**</td>
<td>0.15</td>
<td>0.28**</td>
<td>0.09</td>
<td>-0.33**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ser. Sq.</td>
<td>1.00</td>
<td>0.74**</td>
<td>0.24*</td>
<td>0.22*</td>
<td>0.31**</td>
<td>-0.47**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ser. Fs.</td>
<td>1.00</td>
<td>0.10</td>
<td>0.21*</td>
<td>0.24*</td>
<td>-0.46**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPVT Std.Sc.</td>
<td>1.00</td>
<td>0.35**</td>
<td>0.45**</td>
<td>-0.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Lang</td>
<td>1.00</td>
<td></td>
<td>0.24*</td>
<td>-0.26**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WPPSI Std.Sc.</td>
<td>1.00</td>
<td></td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

Note. Pearson r values with single superscripts are significant at p < 0.01. Pearson r values with double superscripts are significant at p < 0.001. Age Mo. = children's age in months; Class. Sq. = squares classification task scores; Class. Fs. = faces classification task scores; Ser. Sq. = squares seriation task scores; Ser. Fs. = faces seriation task scores; PPVT Std. Sc. = standard scores on the Peabody Picture Vocabulary Task (Dunn & Dunn, 1997); Pain Lang = pain language task scores; WPPSI Std. Sc. = standard scores on the Weschler Preschool and Primary Scale for Intelligence (Weschler, 1989); 'Error' = score on the pain scale accuracy task.
Table 6.

Summary of Hierarchical Regression for Children's Developmental Factor Scores

Predicting Children's Pain Scale Error Scores

<table>
<thead>
<tr>
<th>Measure</th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in Months</td>
<td>-0.11</td>
<td>0.01</td>
<td>-0.58**</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.04</td>
<td>0.42</td>
<td>-0.01</td>
</tr>
<tr>
<td><strong>Stage 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in Months</td>
<td>-0.09</td>
<td>0.03</td>
<td>-0.47**</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.05</td>
<td>0.45</td>
<td>-0.01</td>
</tr>
<tr>
<td>Classification – Squares</td>
<td>0.19</td>
<td>0.29</td>
<td>0.07</td>
</tr>
<tr>
<td>Classification – Faces</td>
<td>-0.19</td>
<td>0.26</td>
<td>-0.09</td>
</tr>
<tr>
<td>Seriation – Squares</td>
<td>-0.08</td>
<td>0.15</td>
<td>-0.08</td>
</tr>
<tr>
<td>Seriation – Faces</td>
<td>-0.04</td>
<td>0.18</td>
<td>-0.03</td>
</tr>
<tr>
<td>PPVT-3 (Standard Score)</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.08</td>
</tr>
<tr>
<td>Pain Language</td>
<td>-0.08</td>
<td>0.12</td>
<td>-0.07</td>
</tr>
<tr>
<td>WPSSI-R (Standard Score)</td>
<td>-0.02</td>
<td>0.04</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

Note. Beta scores with double asterisks are significant at \( p \leq 0.001 \).
Figure Captions

**Figure 1.** Craig's (2002) Sociocommunications Model of pediatric pain.

**Figure 2.** Children's mean error scores by age in year.
Developmental Factors and Self-Report Pain Scales

**CHILD**

- Biological substrates, Personal History
- Pain Experience (thoughts, feelings, sensations)
- Social and physical context

**CAREGIVER**

- Motor abilities
- Sensitivity, Knowledge, Attitudes (biases)
- Assessment or attribution of pain (decoding)
- Relationship to child

**Tissue trauma**

- Pain Expression (self-report, nonverbal display, physiological reactivity)
- Social display rules

- Action, dispositions (pharmacological, cognitive/behavioural, environmental)
Note. Bars of different colours are significantly different at $p < 0.001$. Age labels with asterisk superscripts are significantly different from chance at $p < 0.001$, where error score at chance = 10.49. The dark line on the graph represents this chance score.
Appendix A

Faces Pain Scale – Revised
Note. Numbers represent the coding score that corresponds to each face. These are not shown when using the measure.
Appendix B

Pain Scale Accuracy Task Script (Scripts for the CPPP and FPS-R)
Pain Scale Accuracy Task

Instructions for the Charleston Pediatric Pain Pictures
(Belter et al., 1989)

We're going to play a little game with pictures and stories.

Let me show you some of the things we'll use:

Embedded Instructions for the Faces Pain Scale - Revised
(Hicks et al., 2001)

These faces show how much something can hurt.
This face shows no hurt or pain (point to the left-most face).
The faces show more and more hurt or pain (point the each from left
to right) up to this one (point to right-most face) - it shows very much
hurt or pain.

Now here, I have some stories with pictures! These stories are about you!
When I finish each story, I want you to show me how you feel using the
faces. There are no right or wrong answers, I just want to know how you
feel.

Let's try one.

1. In this picture, you are sitting down and you are looking at a picture-book.
Now show me how much hurt or pain you would have here.

2. In this picture, you were alone in the kitchen by the stove. You touched
the hot stove and got burned on the hand. Now show me how much hurt or
pain you would have here.

3. In this picture, you were outside playing on the sidewalk. You were
running and you stubbed your toe on the sidewalk. Now show me how much
hurt or pain you would have here.
4. In this picture, you are at home and you have a band-aid on your arm. You mother is taking the band-aid off your arm. Now show me how much hurt or pain you would have here.

5. In this picture, you are at the doctor's office for a check-up. He doctor is giving you a shot in the arm. Now show me how much hurt or pain you would have here.

6. In this picture, you are walking in the house. You bumped your head on the table. Now show me how much hurt or pain you would have here.

7. In this picture, you are at the doctor's office for a check-up. The nurse has a thermometer and is taking your temperature. Now show me how much hurt or pain you would have here.

8. In this picture, you were inside playing with some of your friends. Another child got mad and pinched you on the arm. Now show me how much hurt or pain you would have here.

9. In this picture, you were outside playing with some flowers. A bee got mad and stung you on the arm. Now show me how much hurt or pain you would have here.

10. In this picture, you were outside playing with your friends in the yard. Another child pushed you down to the ground. Now show me how much hurt or pain you would have here.

11. In this picture, you were outside running on the sidewalk. You fell down on the sidewalk and your knees got scrapped. Now show me how much hurt or pain you would have here.

12. In this picture, you were outside playing in the yard. You stepped on a bard with a nail in it and the nail stuck in your foot. Now show me how much hurt or pain you would have here.

13. In this picture, you were inside and you wanted to look at the book. The book fell off the table and fell on your foot. Now show me how much hurt or pain you would have here.
14. In this picture, you are at the doctor's office for a check-up. The doctor is listening to your heart. Now show me how much hurt or pain you would have here.

15. In this picture, you are running on the carpet in your house. You tripped and fell down on the carpet. Now show me how much hurt or pain you would have here.

16. In this picture, you were outside playing on the porch. Then you fell down the steps. Now show me how much hurt or pain you would have here.

17. In this picture, you were playing a game with your friends. Now show me how much hurt or pain you would have here.
Appendix C

Sample CPPP Pictures
'No Pain'
'Low Pain'
‘Moderate Pain’
'High Pain'
Appendix D

Script for the Pain Language Task
Pain Language Development Task

Instructions for Counterbalance Version 1

We're going to play another little game with pictures and stories!

Now, here I have some more stories with pictures. These stories are about you! This time, you get to help tell the story too! I'll let you know when it's your turn to talk by going like this (point to child). There are no right or wrong answers, I just want to know what you would say.

Let's try one!

0. In this picture, you are opening presents on your birthday. When you open a really great one, you say: (point to child). Later, when you tell your (parent in room) how you felt when this happened, you say: (point to child).

1. In this picture, you are alone in the kitchen by the stove. When you touch the hot stove and get a burn on the hand, you say: (point to child). Later, when you tell your (parent in room) how you felt when this happened, you say: (point to child).

2. In this picture, you are at the doctor's office for a check-up. When the doctor gives you a shot in the arm, you say: (point to child). Later, when you tell your (parent in room) how you felt when this happened, you say: (point to child).

3. In this picture, you are outside playing with some flowers. When a bee gets mad and stings you on the arm, you say: (point to child). Later, when you tell your (parent in room) how you felt when this happened, you say: (point to child).

4. In this picture, you are outside playing in the yard. When you step on a board with a nail in it and the nail sticks in your foot, you say: (point to child). Later, when you tell your (parent in room) how you felt when this happened, you say: (point to child).