THE IMPACT OF MATERNAL BEHAVIOUR ON CHILDREN’S PAIN EXPERIENCES:
AN EXPERIMENTAL ANALYSIS

by

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Abstract

Pain is a common experience for children, but there can be tremendous variability in pain expression from one child to another. Clinical lore and psychological theory have highlighted the important role parents may play in socializing children’s pain behaviours. For example, certain parental behaviours (e.g., reassurance, criticism) have been linked with increases in child distress, while other behaviours (e.g., humour, suggestions on how to cope) have been linked with decreases in child distress. To date, however, the majority of research examining the relationship between parental behaviours and children’s pain experiences has been correlational and conclusions regarding causality have been limited. The purpose of the present study was to provide an experimental investigation of the impact of maternal behaviour on children’s pain experiences. Participants were 120 children (60 boys, 60 girls) between the ages of 8 and 12 years and their mothers who were recruited from the community. Mothers were trained to interact with their children in one of three randomly assigned ways during a lab-induced cold pressor pain paradigm: 1) a pain-promoting interaction, consisting of reassurance, empathy, apologies, giving control to the child, and criticism; 2) a pain-reducing interaction, consisting of non-procedural talk, humour, and suggestions on how to cope; or 3) a no training control group. The content of the maternal training conditions was based on the previous correlational literature indicating links between certain kinds of parental behaviours and child distress. Children’s pain experiences were assessed using self-report measures of intensity and affect, behavioural coding of facial expressivity, pain tolerance, and heart rate responsiveness during the cold pressor. Results indicated that maternal interaction type had the expected effects on girls’ self-reported ratings of pain intensity; when controlling for the effects of age, girls whose mothers had interacted with
them in the pain-promoting manner reported more pain than girls whose mothers were in the control group, who in turn reported more pain than girls whose mothers had interacted with them in the pain-reducing manner. This effect was not significant for boys. Maternal interaction type had no effect on children’s facial expressivity, ratings of pain affect, pain tolerance, or heart rate responsiveness during the cold pressor. Age was significantly related to children’s ratings on the self-report measures; younger children reported lower levels of pain intensity and affect than older children. There were no gender differences on the majority of the pain measures, with the exception of facial expressivity, where boys evidenced higher scores than girls. These results indicate that maternal behaviour can have a direct impact on girls’ subjective reports of pain and provide evidence of the importance of social learning factors in influencing children’s pain experiences. Future research is needed to extend this research to samples of children experiencing chronic pain, as well as explore the possible role of child characteristics (e.g., coping skills) as moderators of maternal interaction effects.
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The Impact of Maternal Behaviour on Children's Pain Experiences:

An Experimental Analysis

Introduction

Many children experience recurrent or chronic pain conditions which can result in significant disability (e.g., absences from school). Although it is generally recognized that a number of complex factors likely interact to contribute to a child's pain beyond physical pathology, clinical lore and psychological theory have pointed to the influential role that parents play in socializing children's pain experiences (Craig, 1983). Studies of the aggregation of pain complaints in families have implicated the important context of the family in childhood pain (Goodman, McGrath, & Forward, 1997); however, little research has directly explored the specific mechanisms whereby parents transmit information about pain to their children.

While previous empirical research has found significant relationships between certain types of parental behaviours (e.g., discouraging children's coping efforts, providing special attention) and higher levels of children's pain and distress in both acute and chronic situations (Blount et al., 1989; Dunn-Geier, McGrath, Rourke, Latter, & D’Astous, 1986; Walker, Garber, & Greene, 1993), the correlational nature of this previous research has limited conclusions regarding causality and directionality. For example, do certain types of parental behaviours cause children to experience greater levels of pain and behave in a maladaptive manner when in pain? Or do children with more severe pain "pull" for certain types of behaviours from their parents?

While it is acknowledged that parent-child relationships are an interactional process, whereby the actions of one member of the dyad impacts on the actions of the other (Bell, 1979; Maccoby & Martin, 1983), attempting to elucidate parental contributions in parent-child pain interactions has
implications for etiological theories and treatment approaches.

Consequently, the purpose of the present study was to provide an experimental investigation of the impact of maternal behaviour on children's pain experiences. Mothers of healthy, pain-free children were randomly assigned to conditions and trained to interact with their children in one of three ways during a lab-induced cold pressor pain paradigm: 1) pain-promoting interaction; 2) pain-reducing interaction; and 3) natural interaction (no training control group). The content of the training procedures for the pain-promoting and pain-reducing interaction groups was developed based on previous correlational research that had found significant associations between certain types of parental behaviours and either increases or decreases in child pain and distress levels (Blount et al., 1989). The current study explored the impact of interaction type on children's pain experiences, measured by children's self-reports of pain intensity and pain affect, pain tolerance, detailed coding of the children's videotaped facial responses, and heart rate responsiveness during the cold pressor task.

In summary, by randomly assigning mothers to interaction types and having them behave in accordance with structured roles, these data build on previous correlational research by providing an examination of whether parental behaviour can play a direct role in influencing children's pain experiences. Knowledge of the specific mechanisms whereby parents transmit information about how their children should respond to pain has implications for psychological theories of pediatric pain as well as current clinical practice. In the future, this information could be used as a springboard for further research examining parental contributions to pediatric chronic pain.
Literature Review

Pain in Children

Over the normal course of growing up, children frequently experience pain from a number of sources (e.g., ear infections, immunizations). Recent studies examining childhood “everyday pains” (e.g., bumps and bruises) indicate that young children, on average, experience a painful incident once every 3 hours (Fearon, McGrath, & Achat, 1996; von Baeyer, Baskerville, & McGrath, 1998). These pain occurrences are often referred to as acute pain, and typically serve as adaptive biological warning signals, directing attention to an injured body part or disease condition (P.A. McGrath, 1990). Acute pains are usually produced by well-defined noxious stimuli with relatively short durations. This type of pain provides an important warning of actual or impending tissue damage and usually subsides rapidly either on its own or with minor intervention.

With the rare exception of children with congenital insensitivity to pain, virtually all children will experience different forms of acute pain at many points in their lives. A smaller proportion of children develop chronic pain in the form of recurrent or persistent pain problems. Recurrent pain is defined as repeated episodes of circumscribed acute pain (e.g., abdominal pain) over an extended period of time, either experienced as a component of a well characterized medical disorder, or experienced by otherwise healthy children in the absence of a well-defined organic etiology (P.A. McGrath, 1990). Persistent pain is defined as pain that persists beyond the span of time tissue healing would have been expected to resolve (often stated as lasting longer than 6 months). It can be produced by a chronic disease (e.g., juvenile rheumatoid arthritis), or can occur in the absence of clear evidence of ongoing injury or tissue damage (P.A. McGrath,
1990). In persistent and recurrent pain there is often little biologically significant informational value of the pain experience as a warning signal of damage. Epidemiological studies of pain prevalence among children and adolescents have indicated that up to 15% of children experience recurrent pains, while a smaller proportion of children (around 1%) develop persistent pain conditions (Goodman & McGrath, 1991). Both recurrent and persistent pains have been associated with a constellation of features among children, including significant disability (e.g., lengthy absences from school, disruptions in daily activities), familial dysfunction, and mood disturbances (Goodman & McGrath, 1991; Hyams, Burke, Davis, Rzepski, & Androlonis, 1996; Walker et al., 1993). Acute pain (e.g., pain following injury, postoperative pain) also has the potential for destructive psychological, familial, and biological consequences (Craig, 1989). As a consequence, issues related to pediatric pain (e.g., etiology, assessment and treatment strategies) are of considerable interest to researchers and clinicians who work with children.

Definition of Pain

In the past, irrespective of its acute or chronic nature, pain was viewed by scientists and clinicians as purely a biological entity that was thought to occur as a function of a linear process. A noxious stimulus activated the sensory system which then transmitted the energy along the nerves to the brain in a cord-like fashion, with the severity of pain experienced proportional to the tissue damage (Zeltzer, Bush, Chen, & Riveral, 1997). More recently, it has been acknowledged that pain is a complex, multifaceted entity, composed of biological as well as environmental and psychological factors that moderate the relationship between tissue damage and the experience (Craig, 1989). To reflect this conceptualization, the International Association for the Study of Pain (IASP) has defined pain as "an unpleasant sensory and emotional
experience associated with actual or potential tissue damage, or described in terms of such damage" (Merskey & Bogduk, 1994, p. 210).

In the field of pediatric research, the notion of “distress” is often confused with the concept of “pain”. Child distress is a larger umbrella construct which includes within it the child’s pain experience as one component, and some child distress behaviours (e.g., crying, agitation) may also be indicative of pain. In contrast, pain is a more specific construct, and there are potential risks in assuming that children who are in distress are in pain. Indeed, the distinction between children’s more general distress and children’s pain is important to consider as it has implications for current assessment and treatment approaches. For example, in the case of medication use, while children’s anxiety and distress might be best treated with anxiolytics, children’s pain is most appropriately treated with analgesics. Although the distinction between pain and distress is not always an obvious one, and in some instances it may be difficult to discriminate the two, pediatric pain researchers are increasingly trying to refine their pain measurement instruments to maximize the focus on pain, and minimize the focus on more general distress, in the hope of furthering knowledge regarding issues related to childhood pain (Finley & McGrath, 1998). This distinction is important in evaluating previous research on parent effects, as many previous studies have examined distress per se rather than pain (e.g., Blount et al., 1989).

The notion that pain is no longer viewed as purely a sensation generated by nociceptors, but as a perceptual phenomenon with definite psychological and emotional components, has led pediatric researchers to focus not only on biological mechanisms that are related to children’s pain experiences, but on individual child and family factors as well (Zeltzer et al., 1997).
Factors Related to Children’s Pain Experiences

Child factors. At a basic level, research has examined the impact of various demographic factors on children’s pain experiences. For example, a number of researchers have explored the influence of children’s age (as a rough index of developmental level) on their experience of pain. In general, research using children’s self-reports of pain intensity and several broad-band behavioural measures of pain and distress has shown that younger children (i.e., children under the age of 7 years) typically evidence greater reactions to painful stimuli than older children (i.e., children between the ages of 8 and 12 years), who in turn show greater reactions than adolescents (i.e., 13 to 17 year olds) (Arts et al., 1994; Bournaki, 1997; Fradet, McGrath, Kay, Adams, & Luke, 1990; Goodenough et al., 1997; Lander & Fowler-Kerry, 1991). While gender differences in adults’ pain experiences have been well studied, indicating that females typically report more pain than males (Lautenbacher & Rollman, 1993; Unruh, 1996), little research has specifically examined gender differences in the pediatric literature. A few studies have found greater levels of self-reported pain intensity and general behavioural reactivity in response to pain among girls in comparison to boys (Chambers, Giesbrecht, Craig, Bennett, & Huntsman, 1999; Goodenough et al., 1997); however, other studies have not confirmed these effects (Fowler-Kerry & Lander, 1991).

In addition to these basic demographic variables, researchers have focused on individual child characteristics (e.g., coping skills, temperament, emotional state) that might impact on pain experiences. In general, research examining children’s coping skills during pain episodes has shown that higher levels of ruminating and catastrophizing (e.g., worrying about pain) is related to greater pain severity and poorer physical recovery (Bennett-Branson & Craig, 1993; Gil,
Williams, Thompson, & Kinney, 1991; Reid, Gilbert, & McGrath, 1998). With respect to temperament, studies have found that children with easier temperaments (i.e., more adaptable, positive mood, more predictable) tend to report less pain and distress and show better recovery from their pain than children with more difficult temperaments (Carson, Council, & Gravley, 1991; Reid, Chambers, McGrath, & Finley, 1997; Schechter, Bernstein, Beck, Hart, & Scherzer, 1991). Recent research has identified that children with “pain-sensitive” temperaments may be at risk for higher levels of distress during painful medical procedures (Chen, Craske, Katz, Schwartz, & Zeltzer, 2000). In addition, it is generally accepted that a variety of emotional factors (e.g., the presence of anxiety or depression) can heighten children’s experiences of pain (Craig, 1989; Palermo & Drotar, 1996).

**Family factors.** At a broader level, a large body of research has focused on familial influences in pediatric pain. These influences could provide a basis for understanding the origins of some of the child factors already discussed. The majority of knowledge in this area has been obtained through the study of aggregation of pain complaints within families. For example, studies have shown that children with recurrent abdominal pain are more likely to have parents who report similar pain problems (Apley, 1975; Apley & Naish, 1958; Zuckerman, Stevenson, & Bailey, 1987), and that persons with recurrent pain often come from families with a positive family history for pain (Ehde, Holm, & Metzger, 1991; Turkat, Kuczmiczyk, & Adams, 1984).

While the majority of research examining aggregation of pain in families has relied on retrospective reports, a recent prospective community-based study of over 500 families found that children whose parents reported a large number of painful incidents during the 1-week study period were more likely to also report a large number of painful incidents themselves (Goodman
et al., 1997). Although it has been argued that the simple aggregation of pain complaints and problems among family members is not sufficient to show that family factors play a causal role in their etiology (Goodman, McGrath, & Gidron, 1994), and that aggregation of pain complaints in families may occur due to biological factors (e.g., genetics) or other lifestyle factors that families share (e.g., nutrition) (Goodman et al., 1997), this research does highlight the family as a worthwhile context to take into account when considering children’s pain experiences.

Social Learning Theory and Pain

Given the considerable empirical evidence suggesting the influential role of the family in children’s pain, it is reasonable to consider the mechanisms through which information about pain and coping styles is transmitted to children. Although other theoretical models (e.g., psychodynamic theory) have been used to explore and understand parent-child relationships, the theory relating familial factors to childhood pain that has been most influential in psychological research is social learning theory (Craig, 1983, 1986). Social learning theory is also commonly used to help explain how children learn about a variety of psychological phenomena, including aggression (Burton, Nesmith, & Badten, 1997) and delinquency (Winfree, Baeckstroem, & Mays, 1994). Bandura (1971) has suggested that most complex human behaviours are learned through a combination of verbal transmission of information and observation of a skilled model. Indeed, the importance of learning factors in understanding pain has long been hypothesized (Fordyce, 1976), and social learning theory provides a useful framework for investigating how parent-child interactions during episodes of pain might contribute to the socialization of pain responses in children. The application of social learning theory to the etiology and maintenance of children’s pain rests on several learning mechanisms, including social modeling of pain responses by
significant others in the family, parental reinforcement of children’s pain responses, and direct verbal instruction on how to feel or behave. In other words, social learning theory would hypothesize that parents communicate information about how children should respond to pain by showing the children how they themselves react when in pain, and through influencing their children’s responses by directly or indirectly indicating approval or disapproval of how children behave when in pain.

**Parental modeling of pain responses.** By observing how parents define and respond to their own episodes of pain, children may learn how to interpret symptoms of pain and determine what type of response is appropriate. Some empirical support for this learning mechanism comes from studies that have demonstrated that children with recurrent pain of unknown medical origin are more likely to be exposed to salient “pain models” in their daily lives than are children with pain that has an identified organic basis (Osborne, Hatcher, & Richtsmeier, 1989; Robinson, Alverez, & Dodge, 1990; Routh & Ernst, 1984). For example, Osborne et al. (1989) interviewed 20 children with recurrent unexplained pain and 20 children with recurrent explained pain secondary to sickle cell anaemia, as well as their parents, to determine the presence of models of pain or illness behaviour in the child’s environment. Results showed that the children with unexplained pain identified more pain models than children with explained pain. Individuals most commonly identified as “pain models” were parents, followed by siblings, classmates, and other extended family members. In addition, children perceived the frequency and intensity of their own pain to be similar to their models’ pain experiences. The results of this study, and others (Robinson et al., 1990; Routh & Ernst, 1984), appear to support a social learning perspective by indicating that “pain models” are present in the daily environment of children who
develop functional pains, and that the children’s experience of these pains closely follows that of their identified model. In addition to the pain-specific research, similar studies examining children’s adjustment to more general medical conditions (e.g., diabetes) have supported the importance of familial modeling influences (e.g., Turkat, 1982).

However, the previous research examining modeling influences on children’s pain has exclusively relied on retrospective, correlational studies. The limitations of this approach include the potential for reporting bias, as well as the absence of information regarding directionality and the possible presence of other factors that might account for the obtained findings. Experimental research is needed to address these limitations. A number of laboratory analogue studies using experimental pain (e.g., cold pressor, ischemia, pressure, electric shock) have demonstrated that social models can play a substantial role in influencing the subjective experience and display of pain among adults (e.g., Craig & Patrick, 1985; Craig & Prkachin, 1978; Patrick, Craig, & Prkachin, 1986; Thelen & Fry, 1981). However, until recently, no research had examined whether this pattern of results would hold true for children.

A recent study by Goodman and McGrath (1999) attempted to overcome the limitations of previous retrospective research by providing an experimental investigation of parental modeling effects on children’s pain experiences. In this study, the investigators invited a community-based sample of 96 school-aged children, and their parents, to take part in a lab-based cold pressor pain paradigm. First parents were asked to take part in the cold pressor task (with their children observing), and then the children. However, unbeknownst to the children, parents had been “trained” to react in a certain manner during the cold pressor. Some parents were asked to display an exaggerated behavioural reaction to the pain. On the other hand, some
parents were asked to maintain a stoic response. Results showed that children who had observed their parents demonstrate an exaggerated response to the pain had significantly higher scores on the Child Facial Coding System (a pain-specific facial coding system) (Cassidy et al., 1999) during the cold pressor than the children who had observed their parents demonstrate a stoic response; there were no differences in children’s self-reported ratings of pain intensity. The authors concluded that these findings suggest that social learning factors, such as modeling, do have an impact on children’s pain. While this research was a lab-based analogue study using healthy, pain-free children, the experimental nature of the design permitted conclusions to be made regarding the direct impact of observing parental pain responses on children’s subsequent pain experiences.

Parental reinforcement of pain responses and use of direct instruction. Parental responses to children’s verbal and non-verbal reports of pain may have an impact on children’s experiences of pain. In some cases, children may receive direct feedback in the form of instructions on how to behave when in pain (e.g., when a child is told to relax, use an ice pack) (Craig, 1983, 1986). It has also been theorized that children’s pain responses may become subject to principles of reinforcement, whereby the pain behaviour is either positively reinforced by favourable outcomes or negatively reinforced if the pain expression leads to the removal of aversive events (Craig, 1983, 1986). As the responsibility usually rests with parents to administer consequences for child behaviour, both positive and negative, it follows that parents would hold considerable power in influencing their children’s pain experiences. For example, parents may unintentionally encourage the expression of pain by increasing parental attention and decreasing expectations during episodes of pain. Children who receive special attention and privileges during pain
episodes may learn that being in pain carries rewards or permits escape from negative or unpleasant experiences (e.g., school). In some cases, children's pain complaints may serve to distract the family from other problems or provide parents with the opportunity to spend "special time" with their children (Minuchin, Rosman, & Baker, 1978). To reflect its potentially powerful impact on children's pain experiences, parental reinforcement of pain behaviour has been hypothesized as a critical factor that might discriminate between children with pain conditions who become disabled by their pain, as opposed to those children who either recover from the pain or learn to cope effectively (Walker, 1999).

**Empirical Support for the Impact of Parental Behaviour on Children's Pain Experiences**

To date, empirical support for the role that parents may play in influencing pain behaviours and responses in their children has come from three independent research areas: 1) research describing parent-child interactions during episodes of acute pain; 2) research examining the relationship between parental behaviours and children's recurrent and chronic pains; and 3) treatment outcome research describing attempts to modify parental behaviours in response to pediatric chronic pain. Interestingly, these three research areas have developed in relative isolation from one another, but all have empirical implications for our understanding of how parental behaviour might impact on children's pain experiences. Each of these three research literatures will be reviewed and summarized.

**Acute pain research.** One of the first studies to examine parent-child interactions during acute painful medical procedures was conducted by Bush, Melamed, Sheras, and Greenbaum (1986). They observed 50 4- to 10-year-old children and their mothers during painful medical procedures. Four classes of child behaviour (i.e., prosocial, distress, attachment, and exploration)
and six classes of parental behaviour (i.e., distraction, reassurance, ignoring, informing, agitation, and restraining) were coded. Results showed that maternal agitation was linked to increased child distress, and maternal distraction was linked to decreased child distress. Surprisingly, although one might expect maternal reassurance to be linked to decreased child distress, it was actually related to increased child distress. This seems counterintuitive, and not in keeping with the general opinion about the therapeutic benefits of reassurance. While no research has explored why reassurance has been linked to increased child distress, it may be that during acute procedural pain reassurance may function as an indi
cant of the parent’s perception that the upcoming situation is threatening or painful, and may inadvertently trigger or reinforce the onset and continuation of pain and distress behaviours in children.

The majority of recent research examining parent-child interactions during painful procedures has been conducted by Ronald Blount and his colleagues at the University of Georgia. In their first study, Blount et al. (1989) made audiotapes and transcripts of verbal interactions among 23 sets of 5- to 13-year-old children, parents, and medical staff during bone marrow aspirations and lumbar punctures. Child and adult behaviours were coded using a measure developed for use in the study called the Child-Adult Medical Procedure Interaction Scale (CAMPIS), which includes codes for 19 adult behaviours and 16 child behaviours (described below). Behaviours were coded from the audiotapes and transcripts by a group of trained raters. The results showed that particular adult behaviours were closely associated with either coping or distress behaviours by the children when undergoing the painful procedures. Specifically, adults’ reassuring comments, apologies to the child, indicating empathy, giving control to the child, and criticism of the child typically preceded child distress. In addition, adult commands to engage in
coping procedures, non-procedural talk to the child, and humour directed to the child preceded child coping. In other words, similar to the work by Bush et al. (1986), the investigators were successful in delineating certain adult behaviours that were related to either child distress or child coping during painful medical procedures.

A revised version of the CAMPIS, the CAMPIS-R (Child-Adult Medical Procedure Interaction Scale - Revised) was subsequently developed (Blount et al., 1997). The revised measure, based on empirical and conceptual bases, grouped the various adult CAMPIS codes into three general categories: Coping Promoting (i.e., nonprocedural talk to the child, commands to use coping strategy, use of humour); Distress Promoting (i.e., reassuring comments, criticism, apologies, giving control, empathy); and Adult Neutral (e.g., checking child’s status). Similarly, the various child CAMPIS codes were classified into three general categories: Child Coping (e.g., making coping statements, nonprocedural talk by the child); Child Distress (e.g., crying, verbalizing pain); and Child Neutral (e.g., requests for relief from non-procedural discomfort).

Follow-up studies examining patterns of adult-child interaction coded using the CAMPIS-R during different phases of medical procedures (Blount, Sturges, & Powers, 1990), and comparisons of adult behaviours as a function of whether the child could be classified as a “high coper” or “low coper” (Blount, Landolf-Fritsche, Powers, & Sturges, 1992), have provided further empirical support for the pattern of parent-child interactions found in their initial study. Of note, in a study of children undergoing immunizations, 38% of the variance in children’s coping behaviours and 55% of the variance in children’s distress behaviours could be predicted from adults’ coping promoting and distress promoting behaviours (Frank, Blount, Smith, Manimala, & Martin, 1995). Clearly, this provides evidence of the significant strength in the
association between parent and child behaviours during acute painful medical procedures.

In summary, the results of these studies taken together indicate that certain types of parental behaviours are related to child distress and child coping behaviours during acute painful medical procedures. Specifically, it appears that reassuring comments, apologies to the child, indicating empathy, giving control to the child, and criticism of the child are associated with increases in child distress, whereas distracting the child, providing humour directed to the child, and instructing the child to engage in coping strategies are associated with increases in child coping behaviours. The investigators of these studies have generally concluded that these results indicate that parents can have a considerable impact on children’s behaviour during painful procedures (Blount et al., 1989; Frank et al., 1995). While sequential analyses of parent-child interactions, such as those detailed in the studies by Blount and colleagues, are helpful in describing the flow of interactions and determining temporal antecedents and consequences of particular child and adult behaviours, the primary purpose of examining naturalistic sequences of child and adult behaviour is to supposedly provide information regarding cause and effect. However, because of the correlational nature of the data, it is difficult for such research to do more than hypothesis build, rather then directly address issues of causality. For example, one interpretation of the reviewed research could be that parents who do not engage in coping promoting behaviour cause their children to subsequently not utilize coping behaviours (a parent effect). An alternate explanation could be that parents whose children have failed to comply with parental commands to engage in coping strategies in the past simply have learned to no longer provide coping promoting prompts for the current medical procedure (a child effect). Certainly, solid descriptive work such as that conducted by Blount and colleagues is needed to create a
theoretical and empirical basis for understanding parent-child interactions during episodes of pain; however, experimental studies are needed to yield cause-and-effect answers to questions regarding the impact of parental behaviour on children's pain experiences.

To date, only two studies have attempted to directly manipulate maternal behaviour to systematically produce increases or decreases in children's distress behaviours. Gonzalez, Routh, and Armstrong (1993) randomly assigned mothers of 47 three- to seven-year-old children undergoing an injection procedure to a reassurance or distraction condition or a no training control group. Mothers received training in how they should interact through oral instruction, listening to an audio cassette demonstration, brief practice, and the posting of reminders. Results indicated that children in the distraction condition cried less during the procedure than children in the reassurance or no training groups. Although this experimental study confirmed some previous correlational findings, the children of mothers in the reassurance group did not manifest greater levels of behavioural distress than the control condition. A limitation of this study was that parents were trained to reassure their children on an artificial, time-driven schedule and the small sample size may have precluded significant findings.

More recently, Manimala, Blount, and Cohen (2000) randomly assigned 82 parents of children between the ages of 3 and 6 years undergoing immunization injections to either a reassurance, distraction, or control condition. They found that children in the distraction group evidenced the least amount of distress on several measures, whereas children in the reassurance group were restrained a greater number of times and were more fearful than other children. This study provides evidence of direct maternal effects on children's distress behaviours during a medical procedure, but it did not examine the impact of parental behaviour on children's pain.
Indeed, the previous research by Blount and colleagues limits our understanding of how parental behaviour impacts on children's pain experiences. The focus of all prior research on parent-child interactions during acute painful medical procedures has been on child distress. While these studies have often included codes for child verbalizations of pain, and some of the broader distress behaviours might also be indicative of pain (e.g., crying, screaming), to date, the research has not included any of the variety of well-validated measures that are generally thought to be specific to pain (Finley & McGrath, 1998). Hence, the degree to which the reviewed findings on parent-child interactions during medical procedures are relevant to pediatric pain, rather than more global distress, is not known. In spite of these limitations, the research on parent-child interactions during acute painful medical procedures does provide some empirical clues as to what types of parental behaviours might be likely to have a direct impact on how children experience and respond to pain, at least in the short-term.

**Recurrent and persistent pain research.** While previous research has focused primarily on pediatric patients undergoing painful medical procedures (e.g., Blount et al., 1989), far less attention has been devoted to parent-child interactions that occur during the course of recurrent and persistent pains. Given that epidemiological studies indicate that recurrent pains are commonplace for children (Goodman & McGrath, 1991), one might expect that parent-child interactions during these pain episodes would provide a primary arena for the socialization of pain responses in children.

An early study to examine such issues was conducted by Dunn-Geier et al. (1986), who investigated differences in mother-child interactions between a group of 10 adolescents who were coping well with chronic benign intractable pain and a group of 10 adolescents (matched on age,
sex, and pain location) who were not coping well. “Copers” and “non-copers” were classified based on school attendance. Mother-child interaction was video-taped during a 15-minute interaction task in which the adolescent was asked to engage in physical exercise (e.g., sit-ups, step-ups, arm curls) under the supervision of his/her mother. Mother-child interaction was scored using a variation of Mash and Terdal’s (1981) response class matrix which provides information about the antecedents and consequences of a given behaviour. Results showed that “non-copers” had mothers who were significantly more likely to exhibit behaviour that discouraged the adolescents’ efforts at coping with the exercise task and were generally over-involved with their children’s behaviour. The authors concluded in their discussion that, “although these results do not demonstrate a causal relationship between parent-child interactions and coping, the data are consistent with the clinical impression that parental behaviour may influence child coping” (Dunn-Geier et al., 1986, p. 30).

Another investigation examined environmental consequences of pain among a sample of 20 children with recurrent unexplained pain and 20 children with recurrent medically explained pain (Osborne et al., 1989). The school-aged children were interviewed about the positive and negative consequences of their pain by answering two questions: 1) “What do other people do for you when you have your pain?” and 2) “What things that you like to do does the pain keep you from doing?” The responses of each child to both questions were categorized by trained raters as either being positive consequences, negative consequences, or neutral consequences. Positive consequences were defined as those that would increase the probability of the behaviour being repeated, while negative consequences were defined as those that would decrease the probability of the behaviour being repeated. Neutral consequences were defined as those that would not
clearly lead to a change in the probability that the behaviour would be repeated. Using the same questions, parents were also interviewed regarding what they felt the consequences of their children’s pain were. The results of this study indicated that children with explained pain were more likely to report negative consequences of their pain, while children with unexplained pain were more likely to report positive or neutral consequences. Parents’ responses to the interview questions yielded a similar pattern of results. While the interview did not ask children to specify who was responsible for administering consequences, it seems reasonable to assume, given the nature of the consequences provided (e.g., getting to stay home from school), that parents were generally responsible for making these decisions.

In an attempt to better quantify parental responses to child illness and pain behaviour, Walker and Zeman (1992) developed the Illness Behaviour Encouragement Scale (IBES), a 12-item measure of parental responses to children’s episodes of pain and other illness behaviours. Examples of items on this scale include: “How often do you let you child stay home from school when he/she has (symptom)?” and “How often do you spend more time than usual with your child when he/she has (symptom)?” A child form was also created to obtain child perceptions of the degree to which their parents engaged in the various pain and illness behaviour encouragement behaviours. In their initial validation study (Walker & Zeman, 1992), the measure was administered to a sample of 58 pediatric patients ranging in age from 9 to 12 years and their mothers, along with a series of other questionnaires. Parents and children completed the IBES twice, once in response to times when their children experience cold symptoms and once with respect to when their children experience gastrointestinal pains. Results showed significant positive correlations between child-reports and mother-reports on the IBES, suggesting that
mothers and children had similar perceptions of parent-child interactions during episodes of child pain and illness. Further, correlations between IBES scores and scores on other measures of illness behaviour for cold and gastrointestinal symptoms tended to be positive and significant, providing further evidence for the construct validity of the IBES.

The second study described in their initial paper (Walker & Zeman, 1992) used the IBES in a community sample of 7- to 17-year-old children to evaluate the extent to which child age and gender, parent gender, and type of child illness influenced parental encouragement of child illness behaviour. In general, analyses examining child-rated IBES scores showed that girls reported more parental encouragement of their pain and illness behaviour than boys did. Further, children perceived mothers and fathers to be similar in their encouragement of illness behaviour for colds, but mothers were perceived to encourage illness behaviour for gastrointestinal symptoms and pain significantly more than fathers. Analyses using parent IBES scores revealed similar patterns of results, with the exception that parents’ reports of illness behaviour encouragement did not vary as a function of the gender of the child. The lack of parent-rated corroboration of differential illness behaviour encouragement among girls in comparison to boys could be interpreted as indicating that, although the frequency with which parents encourage illness behaviour in girls and boys may not differ, girls may be more aware of and sensitive to their parents’ behaviour. The authors concluded in their general discussion that the IBES, and other applications of social learning theory to the study of parent-child interaction during child illness and pain episodes, should be used to identify parental behaviours that could be effectively targeted in promoting child health.

In an additional study, Walker and colleagues (1993) examined parental encouragement
of illness behaviour, using the IBES, among a sample of pediatric patients with recurrent abdominal pain (RAP), patients with peptic disease, patients with psychiatric disorders, and a group of healthy children. Results showed that children with RAP and children with peptic disease (a condition also resulting in pain) reported receiving more encouragement for pain-related behaviour (e.g., responding with increased attention and special privileges to symptom complaints) than children in the psychiatric or healthy group. The investigators concluded that these data suggested that operant learning may have played a role in the onset or maintenance of illness behaviour in the RAP and peptic disease patients. However, they also acknowledged that “additional work is needed to examine the extent to which these parental behaviours are causes versus consequences of child behaviours” (Walker et al., 1993, p. 255).

In summary, positive consequences of pain (Osborne et al., 1989) and parental discouragement of adaptive coping (Dunn-Geier et al., 1986), have been associated with the presence of unexplained pains and difficulties coping effectively with chronic pains. The research by Walker and Zeman (1992) adds to our knowledge of parental responses to child pain behaviour by showing that the degree to which parents engage in reinforcement of pediatric symptoms varies as a function of the child’s gender, parent’s gender, and the type of symptom being examined. However, while the research appears to indicate that parental responses to and reinforcement of pain in their children may be linked to the development of recurrent pain conditions (Walker et al., 1993), the correlational research on parents’ roles in chronic and recurrent pain suffers from the same constraints on conclusions regarding directionality and causality as evidenced in the research on parent-child interactions during acute painful medical procedures. For example, do certain types of parental behaviours cause children to experience
greater levels of pain and disability and decreased coping? Or do children with more severe pains and disability, and limited coping skills, “pull” for certain types of behaviour from their parents? The correlational research also does not take into account the possibility the role that unidentified, third factors might play in previous findings. In addition, with the exception of the study by Dunn-Geier et al. (1986), the research reviewed relies primarily on retrospective child and parent reports. Finally, in much the same way as the acute pain literature focuses on child distress, the recurrent and chronic pain literature focuses on how children cope with pain. Although children’s ways of coping with pain are important clinical variables to consider, it does not necessarily reflect whether their fundamental pain experience is impacted by their parents’ behaviour.

Pediatric pain treatment research. Quite independently of social learning theory and the empirical research on parents’ roles in acute and recurrent/chronic pains, several studies examining the treatment of children’s pain have incorporated a parent training component. The inclusion of parent training components seems to have arisen from clinical observations and anecdotal evidence regarding the role parents play, perhaps inadvertently, in maintaining children’s pain problems. Indeed, several treatment researchers have highlighted their observation that pain often serves to remove children from undesirable situations (e.g., school) or bring about desirable outcomes (e.g., parental attention), and that parents often are responsible for making decisions about, and administering, these consequences (Masek, Russo, & Varni, 1984). Therefore, decreasing the frequency of child pain behaviours by changing the interaction patterns which are reinforcing the pain behaviours would be a logical step in a comprehensive pediatric pain treatment program.
Given the multitude of factors that contribute to children’s pain, it is not surprising that the empirical data suggest that pharmacological treatment alone is effective with only a minority of pediatric pain patients (Ramsden, Friedman, & Williamson, 1983). While treatment outcome studies have typically included modifications in parent behaviour as part of a larger package (e.g., relaxation, biofeedback), research has generally indicated that parental operant pain behaviour management is an effective adjunct method of treating pediatric pain conditions (e.g., migraine, recurrent abdominal pain) (e.g., Allen & McKeen, 1991; Barry & von Baeyer, 1997; Mehegan, Masek, Harrison, Russo, & Leviton, 1987; Sanders et al., 1989). General guidelines for modifying parental behaviour in response to their children’s pain have included such suggestions as: “provide frequent approval for maintaining normal activity” and “ignore excessive complaining, pain gestures, and requests for special treatment and assistance” (Masek et al., 1984).

To date, the only study which has involved a direct, controlled manipulation of parental contingencies for pain behaviour in the management of children’s pain was conducted by Allen and Shriver (1998). They randomly assigned 27 children between the ages of 7 and 18 years who met diagnostic criteria for migraine headache to either a biofeedback treatment group or a biofeedback group that also included pain behaviour management guidelines for parents. The pain behaviour guidelines for parents included encouraging independent management of pain, encouraging normal activity during pain episodes, eliminating status checks, reducing parental response to pain behaviour, reducing pharmacological dependence, treating pain requiring a reduction in activity as illness (e.g., requiring bed rest), and recruiting other family members to follow the same guidelines. Although no direct measures of parental compliance with treatment
were obtained, results showed that children in both treatment groups improved, but that the children whose parents were assigned to follow the pain behaviour management strategies were more likely to experience clinically significant improvements in headache activity, were more likely to be headache free, and showed better levels of adaptive functioning at a 3-month follow-up in comparison to children who received only the biofeedback treatment.

In summary, the treatment literature has highlighted the important role parents may play in children's pain conditions by showing that altering parental responses can have a beneficial impact on children's pain. However, evidence that altering parental behaviour is effective in managing and decreasing children's pain is not sufficient to conclude that naturally occurring parental behaviour plays a causal role in triggering or maintaining that pain. The inclusion of parent training components in these treatment programs, developed in relative isolation of the empirical research on parent-child interactions during acute and chronic pain, does, however, provide clinical evidence supporting the need to consider the role of parental behaviour in children's pain experiences.

Summary of reviewed research. In the short term, it appears that parental reactions to children's behaviour (e.g., reassurance, criticism) may result in increases in children's distress during acute painful medical procedures. When considering longer-term pains, it also appears that certain kinds of parental behaviours (e.g., discouraging children's coping efforts, providing special attention) are associated with difficulties coping with pain and perhaps a greater likelihood to develop recurrent or chronic pain conditions. While no research has examined the relationship between parental behaviour during acute painful procedures and their responses to longer term child pains, across these types of pain the behaviours linked to poorer child outcome
appear consistent. For example, providing reassurance during acute pain seems to parallel providing special attention during more chronic pain episodes. In addition, treatment studies suggest that modifying parental behaviour in response to pain may result in the reduction of pain symptoms and disability in pediatric patients. Consistent with social learning theory, these three separate lines of research provide converging presumptive evidence for an important causal role of parental behaviour in children's pain.

However, while the research on acute and recurrent/chronic pains has described relationships between certain types of parental behaviours and child pain, distress, and coping variables, prospective experimental research is needed to elucidate the direct role that mechanisms such as parental behaviour play within parent-child dyads to produce pain and disability. In addition, future research that focuses directly on children's pain experiences, and not simply on children's more general coping and distress behaviours, is needed to further knowledge regarding the impact of parental behaviour on children's pain.

Outside the area of childhood pain, the quest to tease out direct parent effects in parent-child interactions is not unprecedented. Investigators in the more general field of parenting research have long been interested in the impact of parental behaviour on child behaviour. It is useful to briefly consider how researchers in this field have attempted to address this issue, and to review what methodological strategies can be gleaned from this research. In addition, prior to exploring how one might apply experimental designs to the study of pediatric pain, two additional issues should be considered, namely how we can best measure pain in children, and what setting/paradigm is most useful to study pain responses in children.
Methodological Considerations

Parenting research. It has long been cautioned that the study of parent-child interactions is that of a dynamic, interactive, and circular process, whereby the actions of one member of the dyad impact on the actions of the other (Bell, 1979; Maccoby & Martin, 1983). Consequently, this interactive nature of parent-child relationships has made it difficult to tease apart parent and child effects. Indeed, our knowledge of the most effective ways to discipline children is actually based on correlational research data that do not allow causal conclusions to be drawn. Inasmuch, the study of the effects of parental behaviour (usually parenting practices and strategies) on children’s general behaviour (e.g., misbehaviour, non-compliance) has suffered from similar constraints on conclusions of causality as in the pediatric pain literature. However, this does not mean that it is not interesting and meaningful to attempt to delineate relative parent and child influences. Knowledge of direct parent effects on child behaviour aids in the development of clear guidelines that can be given for parenting strategies.

Using lab-based experimental manipulations of parental behaviour, a few investigators have attempted to draw conclusions regarding the effects of different parenting practices. For example, Parpal and Maccoby (1985) contrasted three modes of mother-child interaction on children’s subsequent compliance in a lab-based study by randomly assigning mothers of 39 preschoolers to trained responsive play, non-interactive play, or free play (the untrained control condition). Mothers in the responsive play condition were asked to use techniques that they had been taught in a previous training session (which involved verbal instruction and a role-played demonstration), while mothers in the non-interactive condition were asked to complete a questionnaire while their children played in the same room. Mothers in the free play condition
were simply asked to play with their children just as they would at home. As a manipulation
check, mothers’ verbalizations and behaviours during the play sessions were coded by a blind
observer to ensure adherence to their training conditions. Immediately following the 15-minute
play session, children completed a compliance test where the mother was asked to give
commands to the child (e.g., “Susie, put this car in the box”) and children’s behaviour in
response to the commands was coded. Results of the investigators’ check revealed that their
manipulation had been effective; there was little interaction between mothers and children in the
non-interactive condition, and mothers in the responsiveness group showed more responsive
behaviours and less control behaviours (e.g., providing directives, asking questions) toward their
children than mothers in the free play control condition. Results of the primary analyses showed
that there was a significant main effect for condition type, and that children who were in the free
play group were significantly less compliant than children who were in the responsive play group
or the non-interactive group. In other words, the type of parental behaviour evidenced during the
play session appears to have had a direct effect on subsequent child compliance in this lab-based
study.

Using a similar experimental design, Reid, O’Leary, and Wolff (1994) examined the
efficacy of two commonly used strategies for controlling toddler behaviour: distraction (i.e.,
diverting the child’s attention from an undesirable activity by suggesting an appropriate
behaviour) and reprimands (i.e., expression of the mother’s disapproval of the child’s behaviour).
While previous correlational research had shown a positive association between mothers’ use of
reprimands, but not distraction, and toddlers’ compliance (Kuczynski, Kochanska, Radke-
Yarrow, & Girnius-Brown, 1987), knowledge regarding the direct effects of maternal use of
distraction and reprimands was limited. The investigators randomly assigned mothers to respond to their toddlers’ misbehaviour (e.g., touching forbidden objects) in two ways during a “waiting room” situation: a distraction phase followed by a reprimand phase, or a reprimand phase followed by a distraction phase. Each distraction and reprimand phase lasted for 8 minutes. Instructions for mothers on how to respond to their children’s misbehaviours were provided via a bug-in-the-ear device. Blind raters coded mother and child behaviours (i.e., transgressions, negative affect). The manipulation check of maternal behaviours confirmed that mothers complied with the experimental instructions. Overall, results showed that, when reprimands were used as the initial strategy, parents were significantly more effective in controlling children’s transgressions. On the other hand, when reprimands were used following a period of distraction, children’s rates of negative affect increased significantly. Consequently, similar to the study by Parpal and Maccoby (1985), these investigators were successful in providing experimental documentation of differences in the effectiveness of two parenting discipline strategies.

From a methodological stand-point, the reviewed studies highlight the scientific value of lab-based experimental manipulations in addressing issues concerning the impact of parental behaviour on children’s subsequent behaviour (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000). This research strategy would lend itself to the study of the effects of parental behaviour on children’s pain experiences. In addition, this research also shows that parents are capable of altering their behaviour in a requested manner in a lab-based situation after relatively minimal instruction. The difficulty reported by previous researchers in manipulating maternal behaviour during painful medical procedures (Gonzalez et al., 1993) may be due in part to the high stress nature of the clinical situations studied. It is likely that parents may be better able to
modify their normal response patterns in a less threatening, laboratory analogue setting.

The measurement of pain in children. The reliable and valid assessment of pain in children is a considerable challenge for researchers and clinicians. However, it is essential to our thorough understanding of children’s pain experiences. Unfortunately, previous investigators have paid little attention to the psychometric properties of the measures used to assess pain, and have often confused the construct of pain with more general constructs (e.g., distress). It is generally held that there are three methods whereby pain can be assessed: 1) self-report measures (i.e., what a child says); 2) behavioural measures (i.e., what a child does); and 3) physiological measures (i.e., how the child’s body reacts). A variety of measures designed to assess each of these three areas currently exist (Finley & McGrath, 1998).

Pain is a highly individualized and subjective event, therefore a child’s self-report is generally thought to be the most direct means of accessing subjective experiences such as pain and is considered to be the “gold standard” for pain assessment (Merskey & Bogduk, 1994), despite its limitations (Jensen, 1997). There exist a number of measures designed to elicit self-reports of pain intensity from children, including pain thermometers graded in intensity, word-graphic rating scales, and visual analogue scales (Champion, Goodenough, von Baeyer, & Thomas, 1998). In recent years, considerable attention has been devoted to “faces scales”, which show a series of faces, typically hand-drawn, with the faces graded in increasing intensity between “no pain” and “worst pain possible”. When presented with a faces scale, children are asked to point to the face that best shows how much pain they are currently experiencing. Faces scales, unlike other self-report measures, are thought to be easily understood by children in that they do not require the child to translate their pain experience into a numerical value. Several
studies have shown that faces scales are preferred by children, parents, and nurses, when compared to other assessment tools, including visual analogue scales and word descriptor scales (e.g., Fogel-Keck, Gerkmansmeyer, Joyce, & Schade, 1996), and recent studies have shown that faces scales that begin with a relatively neutral “no pain” face provide the most valid self-reports of pain intensity from children (Chambers & Craig, 1998; Chambers et al., 1999). The faces scale which is currently most commonly used in pediatric pain research to measure pain intensity is the Faces Pain Scale created by Bieri, Reeve, Champion, Addicoat, and Ziegler (1990).

A separate but related construct to pain intensity is pain affect, which is considered to be an individual’s emotional response to pain (Craig, 1989). When assessing pain affect, children are usually asked to report how unpleasant or “yucky” the pain made them feel. Relative to the research on the measurement of pain intensity, pain affect has received considerably less attention, but it is generally accepted that the faces scale developed by P.A. McGrath, de Veber, and Hearn (1985) does an excellent job of tapping at this construct. An increasing number of researchers are incorporating measures of both intensity and affect in their studies to provide a comprehensive understanding of children’s pain experiences (e.g., Goodenough et al., 1999).

However, children are not always able to provide self-reports of pain. For example, young children (due to cognitive limitations) and children who are too distressed or frightened may be unable to provide reliable and valid self-reports of pain. Consequently, considerable research has focused on behavioural measures of pain (Craig, 1998; McGrath, 1998), including measures of child vocalizations, gross body movements, and facial expression. Research attempts to isolate a “pain cry” in infants, based on its psycho-acoustic properties, have generally been unsuccessful (Craig, Gilbert-MacLeod, & Lilley, 2000; Grunau & Craig, 1987; Johnston & Strada, 1986).
With respect to gross body movements, several pain-specific measures have been developed, including the Children’s Hospital of Eastern Ontario Pain Scale (CHEOPS; McGrath et al., 1985), the Toddler-Preschool Postoperative Pain Scale (Tarbell, Cohen, & Marsh, 1992) and the Postoperative Pain Score (Attia, Amiel-Tison, Mayer, & Shnider, 1987). However, these measures have only been validated for use in the postoperative period. Several broad-band behavioural measures have been developed to examine children’s more general distress during acute pain procedures (e.g., the Observational Scale of Behavioural Distress; OSBD; Jay, Ozolins, Elliott, & Caldwell, 1983), yet, these measures have generally not been shown to be specific to pain.

The most promising behavioural measure of pain appears to be fine-grained analysis of facial expression (Craig, 1998). Typically, children’s facial expressions in response to pain are video-taped and then later for the incidence and intensity of discrete facial movements coded by trained raters on a second by second basis. Measures of facial expression have been developed for neonates (Neonatal Facial Coding System; NFCS; Grunau & Craig, 1987) and more recently for preschoolers and school-aged children (Child Facial Coding System; CFCS; Cassidy et al., 1999; Gilbert et al., 1999). These measures of facial expression have shown good reliability and validity and have been applied to both acute and persistent pains. According to Prkachin (1992), five facial actions (i.e., lowering of the brow, squeezing of the eyes, raising of the cheeks, wrinkling of the nose, and raising of the upper lip) have been found to provide the bulk of information about pain across a variety of pain situations (e.g., cold pressor pain, ischemic pain, pain from electric shock, pressure-induced pain). Behavioural measures, such as facial expression, are thought to hold a distinct advantage over self-report measures as they appear to
not be as vulnerable to reporting biases and environmental influences (Craig, 1998).

Physiological measures are the least commonly obtained measures of pain in children. A variety of different physiological measures have been examined, and sufficient data are available on heart rate, transcutaneous oxygen, palmar sweating, and stress response to show that they have validity as sensitive to pain in the instance of acute pain, but not for longer term pain (e.g., postoperative pain), due to habituation (Sweet & McGrath, 1998) and their specificity can be questioned as they appear to reflect stress rather than the specific qualities of pain. Heart rate (i.e., the number of beats per unit of time) is the most widely used physiological measure of pain, likely due to the ease with which it can be obtained (Sweet & McGrath, 1998). Of the three different types of pain measurement strategies, there is most concern about the specificity of physiological measures to pain, although it is generally regarded that physiological measures can provide useful convergent information in addition to the data provided by more specific self-report and behavioural measures (Sweet & McGrath, 1998).

In summary, a variety of different measures of pain are available for use with children. It is generally believed that the reviewed measures are reliable and valid as measures of pain, however it is acknowledged that it would be virtually impossible for a measure to completely remove the influence of more general distress. Further, studies examining the relationship among self-report, behavioural, and physiological measures indicate that, while they may be loosely related, discordance among the different measures is common (Beyer, McGrath, & Berde, 1990). Consequently, it is generally recommended that a combination of self-report, behavioural, and physiological measures should be used to provide a comprehensive account of children’s pain experiences (Finley & McGrath, 1998).
Clinical versus laboratory-based investigations of pain in children. Knowledge regarding pediatric pain has typically been gained through clinical investigations of sick children undergoing painful medical procedures (e.g., venepuncture, lumbar puncture). Although much has been learned from these studies, there are a number of confounding variables inherent in clinical investigations, including the status of the child’s illness, technical difficulties in performing a medical procedure, the meaning of the procedure and illness to the child, the child’s emotional state (e.g., anxiety), and the use of analgesic medication (LeBaron, Zeltzer, & Fanurik, 1989). Indeed, the recent increase in accessibility of topical local anaesthetics (available over-the-counter at pharmacies) which can be applied by parents to children’s skin prior to medical procedures (e.g., EMLA; Eutectic Mixture of Local Anaesthetics) has led to popular use. For example, in a recent study examining pain induced by venepuncture, we found that approximately half of the children included in the study were using EMLA to manage their pain (Chambers et al., 1999). The use of EMLA served to reduce the overall level of pain ratings provided by the children as compared to previous research examining venepuncture pain without the use of EMLA (e.g., Maunuksela, Olkkola, & Korpela, 1987). Although, from a clinical perspective, it is desirable for any unnecessary pain in children to be managed appropriately, the increasing use of analgesia in clinical settings has complicated the scientific study of pain in children.

An alternative to clinical studies of pain in children is laboratory investigation. Laboratory-based studies of pain in children have typically been avoided by researchers, likely due to ethical concerns about the well-being of child participants. However, the cold pressor, a laboratory model used to study pain in adults, has been demonstrated to be non-harmful and
ideally suited as a pain paradigm in children because the duration of the discomfort is entirely controlled by the participant (LeBaron et al., 1989). In the cold pressor paradigm, individuals are asked to lower their arm into a chest of cold water (typically 1-2°C among adults). Individuals are told that they can remove their arm from the water at any time. There are no long-term health consequences of the task and any discomfort experienced subsides rapidly once the arm is removed from the water.

Several studies have examined the feasibility of the cold pressor paradigm among children (Fanurik, Zeltzer, Roberts, & Blount, 1993; LeBaron et al., 1989; Zeltzer, Fanurik, & LeBaron, 1989). While there has been some variability with respect to the temperature of the water used (ranging from 10°C to 15°C), the general conclusion arising from this body of research has been that the cold pressor is a suitable pain paradigm for use with children. Although it induces pain, the cold pressor task is generally perceived by children and their parents as an interesting and non-stressful experience (Zeltzer et al., 1989). In support, in a recently completed project using the cold pressor to examine developmental differences in the congruence of multiple measures of pain in children (Chambers et al., 2000), we found that (using 10°C water) the paradigm was successful in producing levels of pain among school-aged children that would be classified as "clinically significant" (Gauthier, Finley, & McGrath, 1998). In addition, based on anecdotal reports and observation of the children who participated, the cold pressor was perceived as an educational experience for children (Chambers et al., 2000). Although there are many advantages to the use of the cold pressor for studying pain responses in children, there are also several disadvantages, including the fact that the pain experienced during the cold pressor is not very similar to other types of pain more commonly experienced by
children. Regardless, the laboratory-based cold pressor paradigm appears to be an excellent method for advancing knowledge regarding factors related to childhood pain by helping to reduce the influence of confounding variables. Further, given the acceptability of the cold pressor to both parents and children, it is likely that maternal behaviour would be easier to manipulate in this experimental situation as compared to more distressing and stressful clinical situations.

Overview of the Proposed Study

The purpose of the present study was to provide an experimental investigation of the impact of maternal behaviour on healthy school-aged children's pain experiences. Mothers were chosen as the focus of this investigation as previous research has demonstrated that mothers are most likely to care for their children during episodes of pain and illness (Finley, McGrath, Forward, McNeill, & Fitzgerald, 1996), and also because mothers have been reported to be more likely to reinforce child pain behaviours than fathers (Walker & Zeman, 1992). Mothers of healthy, pain-free children were randomly assigned and trained to interact with their children in one of three ways during a lab-induced cold pressor pain experience: 1) pain-promoting interaction; 2) pain-reducing interaction; and 3) natural interaction (no training control group). The content of the training procedures for the pain-promoting and pain-reducing interaction groups were developed based on the previous empirical research that has found significant associations between certain types of parental behaviours and either increases or decreases in child distress levels (Blount et al., 1989). The impact of interaction type on children's pain experiences, measured by obtaining children's self-reports of pain intensity and pain affect, pain tolerance, detailed coding of the children's videotaped facial responses, and heart rate responsiveness during the cold pressor, were examined. In addition, given the knowledge of
gender differences in children’s experiences of pain, analyses also examined the general impact of children’s gender on their pain experiences in the current study. Further, given reports that girls perceive their mothers as engaging in more illness behaviour encouragement than do boys (Walker & Zeman, 1992), the possibility that girls may be more sensitive and responsive to parental behaviour during episodes of pain was explored. Consequently, the current study was a 2 (child gender: boy versus girl) X 3 (maternal interaction type: pain-promoting versus pain-reducing versus natural reaction) between-subjects design. The labelling of the different maternal interaction types (i.e., pain-promoting, pain-reducing) was based on the hypothesized direction of the maternal interaction effects, as described below.

It was hypothesized that children, both boys and girls, of mothers in the pain-promoting group would score higher on the various measures of pain during the cold pressor task than children of mothers in the control group, followed by children of mothers in the pain-reducing group. It was also hypothesized that girls, regardless of their maternal interaction type, would score higher than boys on the various pain measures. Finally, it was hypothesized that there would be an interaction between child’s gender and maternal interaction type, in that girls’ pain responses in both of the maternal training conditions would be most affected (i.e., increased in the pain-promoting condition and decreased in the pain-reducing condition) by the experimental manipulation of their mothers’ behaviour in comparison to boys.

Method

Participants

The sample consisted of 120 (60 boys, 60 girls) healthy 8- to 12-year-old children ($M = 9.74$ years, $SD = 1.41$ years) with no history of recurrent or chronic pains other than typical
childhood pains (e.g., occasional ear infections), along with their mothers. This age range was specified since children in this age group have the developmental capacity to provide reliable and valid self-reports of pain, and also because the pain experienced by children across this age range tends to be similar (Champion et al., 1998). The sample was restricted to healthy pain-free children to limit the potentially confounding effects of a salient history of previous parent-child interactions surrounding pain and illness symptoms. The data from an additional 7 children was excluded due to technical difficulties (e.g., equipment malfunction). The ethnic breakdown of participating children, as reported by their mothers, was as follows: 1) Caucasian (n = 83; 69.7%); 2) Asian (n = 13; 10.9%); 3) Indo-Canadian (n = 4; 3.4%); 4) First Nations (n = 1; 0.8%); and 5) other (e.g., Asian/Caucasian) (n = 18; 15.1%). Participating mothers had a mean age of 41.48 years (range = 27 to 55 years; SD = 5.48 years) and 70% of mothers were married (n = 84). Families were of middle to upper social class (M = 29.40; SD = 15.77; Class II, Hollingshead Index; Miller, 1983). They were recruited using posters and advertisements placed in local newspapers, schools, libraries, community centres, radio stations, and children’s groups (Appendix A). Children were randomly assigned to one of three groups: 1) a pain-promoting group (n = 40); 2) a pain-reducing group (n = 40); and 3) a control group (n = 40), with the restraint that there should be an equal number of boys and girls in each group.

Procedure

Interested mothers who contacted the research lab completed a brief telephone screening administered by a research assistant to ensure eligibility for the study (e.g., English speaking family, appropriate child age). Provided that eligibility requirements were met, mothers were given a brief summary of the study (i.e., that we were interested in looking at what kinds of
factors influence how children learn to respond to pain) and an explanation of the cold pressor task (e.g., that children would be asked to submerge their hand into a cooler of cool 10 degree Celsius water, that most children find it to be an interesting experience, and that children could remove their hand from the water at any time). If the mother continued to express an interest in participating, an appointment to come to the lab was scheduled, and a reminder card and campus map were sent by mail. Appointments were confirmed by telephone the day prior to the scheduled appointment.

On the day of testing, after a brief introduction, the general purpose of the study was reviewed with the family. Mothers and children were then separated for approximately 20 minutes. A research assistant with the child explained how to use the cold pressor and trained the child in how to use the self-report pain measures in a similar manner that has been used in previous research (Goodenough et al., 1999; Appendix B). The remainder of the 20-minute interval with the child was spent playing a game of the child’s choice (e.g., Connect Four, Snakes and Ladders) until their mother was brought into the room. Meanwhile, if the mother had been assigned to one of the two training groups, a research assistant with the mother revealed that the main purpose of the study was to examine the impact of maternal behaviour on children’s pain experiences, and that mothers would be randomly assigned and trained to interact with their children in a certain manner. Mothers assigned to the control group were told that the purpose of the study was to examine general factors that impact on children’s pain, so as not to alert them to the true purpose of the study and influence their interaction style with their child during the cold pressor. Written informed consent was obtained from mothers (Appendix C & D). Mothers were also asked to provide some basic demographic information (Appendix E). Depending on the
group to which they had been randomly assigned, mothers were trained to interact with their children in either the pain-promoting or pain-reducing manner (see below). Control parents also were kept separated from their children for a 20-minute interval.

When reunited, the mother’s help was enlisted to put the heart rate chest band on the child, and final instructions regarding use of the cold pressor were given. It was explained that children and their mothers would be asked to wait for 2 minutes, and then a beep would signal the time for them to lower their left hand into the water, just past the wrist-fold. Children were asked to try to leave their hand in the water as long as they possibly could, but were reminded that they could remove their hand from the water at any time if they felt they could not tolerate it anymore. Otherwise, another beep after 4 minutes signaled that it was time to remove their hand from the water. They were told that the research assistants would be waiting in another room, and would come in at the end of the 6 minute period; however, if they needed to talk to one of the research assistants or finished early, they could simply knock on the door. Children’s facial expressions during the 6 minute period were videotaped through a one-way mirror, which was mostly covered with a curtain, using a standard VHS camera mounted on a tripod. All parents, regardless of group, were seated at the same position, approximately 4 feet across from their child.

Following the 6 minute period, or the child’s removal of their arm from the water, whichever occurred first, the research assistants returned to the room to obtain the child’s self-reports of pain intensity and affect reflecting their experience while their hand was in the water (Appendix F). The order in which the pain intensity and affect measures were presented was randomized for each child. Self-reports were obtained from the child with the mother in the
room. The mother and child were then again separated in order to ask them some additional questions about the experience (see below). Finally, the mother and child were reunited. Mothers in the control group were debriefed as to the true purposes of the study (i.e., that we were interested in the impact of parental behaviour on children's pain) and were advised that we were not able to tell them prior to the experimental session as it might have had an impact on how they interacted with their child during the cold pressor. In addition, a thorough and sensitive debriefing was conducted with the child (i.e., that we had videotaped their faces so that we could see how their faces reacted when their arm was in the cold water, and for children of parents in the training group, that we had asked their mother to behave a certain way with them to see if it would have an effect on how they felt during the cold pressor). Children received a junior scientist certificate (Appendix G) with a sticker and a $5 gift certificate to a local movie theater to acknowledge their participation. Mothers received $5 to reimburse them for parking and transportation expenses.

Experimental Manipulation

Given that all previous research that had examined parent-child interactions during pain focused on the content of parent verbalizations (and not other aspects of the parents' behaviour, such as non-verbal displays or vocal tone), the training for the current study focused on manipulating mothers' verbalizations during the cold pressor task. Based on the research by Blount and colleagues, the pain-promoting interaction consisted of parental verbalizations designed to be reassuring, provide empathy or apologies, provide mild-criticism, and give control to the child. The pain-reducing interaction consisted of parental verbalizations designed to distract the child with non-procedural talk, humour directed to the child, and commands to
engage in coping strategies. Parents in the no training control group were simply asked to interact with their children in the same way as they normally would. Mothers were not aware of the hypothesized direction of the effects of their training group.

To develop the parent verbalization training scripts, a list of 56 potential pain-promoting and pain-reducing parental verbalizations was generated by a group of undergraduate and graduate students in psychology and also from the raw data (i.e., videotapes) and coding guides from previous research examining parent-child interactions during pain (e.g., Blount et al., 1997, Reid, McGrath, & Lang, 1999). To provide content validity for the items, a group of 10 researchers and clinicians with expertise in pediatric pain were asked to classify items into either the pain-promoting or pain-reducing categories using operational definitions for the CAMPIS specific codes (e.g., reassurance) from the CAMPIS-R coding manual (Blount et al., 1989). Final training items were chosen from among those that showed greater than 85% agreement with respect to category placement.

Mothers were trained to interact with their children in either the pain-promoting or pain-reducing manner in a four-step process which included: 1) verbal instruction and discussion; 2) a sheet of written reminders; 3) video demonstration; and 4) role modeled practice. First, mothers were given a general verbal explanation of the manner in which they should interact with their children. For example, mothers in the pain-reducing interaction group were told “While you’re with your child, both before and during the time they have their arm in the water, we’d like you to try as much as you can to distract your child from what they are doing (e.g., by talking about your plans for the weekend), give them some specific ideas about what they could do to make themselves feel better while their arm is in the water (e.g., asking them to wiggle their fingers...
around), or try to crack some jokes or be funny with your child.” Secondly, mothers were shown a sheet of paper with a general description of their interaction type at the top and a list of potential verbalizations that they could use during the cold pressor task (Appendix H & I), and mothers were asked if they could think of any additional verbalizations that could be added to the list. Then, mothers were asked to circle 10 verbalizations that they would feel comfortable using. This provided the parents with some flexibility and choice in what they could say (perhaps increasing the likelihood that they would use the appropriate training prompts), yet kept the type of verbalizations relatively constant across mothers. Parents were asked to say at least three of the verbalizations before the child submerged their hand in the water, and then at least six verbalizations while their child had their hand in the water (equivalent to the rate of 1.5 verbalizations per minute). These numbers were specified after some initial piloting, and appeared to represent a reasonably comfortable number of verbalizations for the parents to state given the time allotted. The piloting indicated that asking parents to provide verbalizations in a more structured manner (e.g., every 15 seconds) was perceived by children as very artificial and obvious, and was also very awkward for the parents. Setting a minimum limit allowed mothers some flexibility in choosing when and what they could say, which was more in keeping with naturally occurring parent behaviour, but also ensured that a minimum number of verbalizations were initiated. Mothers also were given some direct instructions regarding what not to say during the cold pressor task. For example, mothers in the pain-promoting group were told “Please do not say anything to your child that might distract them from what they are doing. Please do not give them any specific suggestions for things that they could do to make themselves feel better when their arm is in the water (e.g., taking a deep breath). And please try not to crack any jokes or be
funny with your child”. The restrictions on verbalizations appeared at the bottom of the page where the mothers had circled the verbalizations that they would be able to say. In addition, mothers were given brief guidance as to how to answer questions their children asked of them. In previous research using the cold pressor, the most commonly asked question by children was “Can I take my hand out of the water now?” (Chambers et al., 2000). In order for the cold pressor to be deemed ethically acceptable by the UBC Behavioural Research Ethics Board, it was necessary for mothers in all three groups to respond to their children that they were in control of the duration of the experimentally induced pain situation. Therefore, mothers in the pain-promoting group were told to say “I know it must be cold, remember you can take your arm out whenever you want”, whereas parents in the pain-reducing group were told to say “Try wiggling your fingers around, remember you can take your arm out whenever you want”. Following the verbal instructions, mothers were shown a videotape of a parent and child completing the cold pressor task, with the parent in the video providing the appropriate verbalizations for their training group. Next, to give mothers an opportunity to practice their assigned verbalizations, a brief role-play, with the research assistant pretending to be the child, was conducted with the parents. Finally, mothers were given a clip board with their reminder sheet attached to it to take in with them during the cold pressor task (Appendix H & I). This format of training, rather than using the bug-in-ear technique which is sometimes used with parents of younger children, was chosen given the likelihood that the bug-in-ear device would be visible to the older children in this study, and also given anecdotal reports of parental difficulties using bug-in-ear devices (e.g., talking back to the experimenter, confusion).

For mothers in the control condition, after the signing of their consent form and
completion of demographic information, they were provided with some more detailed verbal information about the cold pressor and were shown a video generally describing the current research projects in the lab. Following the viewing, the video was discussed with the parent and questions were answered. The mothers in the control group received a written set of instructions about the cold pressor on a clip board to keep with them during the task (Appendix J). Mothers were casually told to “feel free to talk and act with your child as you normally would” and were told, if the child asked them if they could take their hand out of the water, to remind them that they can take it out whenever they want.

**Apparatus**

The cold pressor device consisted of a commercially manufactured cooler measuring 23.5 cm wide, 43.5 cm long, and 28.0 cm deep. There was a square opening in the lid (11 cm by 11 cm) through which children could lower their hand. A plastic porous screen divided the chest and separated the region where the ice cubes remained from the compartment where the child’s hand was immersed. The water was maintained at a temperature of 10 degrees Celsius (+/- 1 degree). The water was circulated by a pump, to prevent local warming around the arm. A ground fault circuit interrupter protected the pump’s power line.

**Measures**

- **Demographic checklist.** Parents provided basic demographic data (e.g., parents' marital status, occupation, education). Socioeconomic status (SES) was calculated using the Hollingshead Index (Miller, 1983). Lower scores indicate higher levels of socioeconomic status.

- **Pain intensity.** The Faces Pain Scale (Bieri et al., 1990) includes seven faces depicting increasing gradations of pain severity, from “no pain” on the extreme left face, to “most pain
possible” on the extreme right face. Children were asked to choose a face to indicate their level of pain intensity. The scale is scored on a 0 to 6 scale, with 0 representing “no pain” and 6 representing “most pain possible”. The scale has shown good evidence of reliability, validity, and preliminary ratio scaling properties (Bieri et al., 1990). Children were asked to use the Faces Pain Scale to indicate how much pain “on average or taken altogether” they had when their hand was in the water, as well as what the “worst pain” was when they had their hand in the water. Given that a large proportion of the children (approximately 35%) in this study experienced difficulties and confusion when asked to rate their average pain level, only the worst pain ratings were used for the purpose of data analyses.

Pain affect. The Facial Affective Scale (P.A. McGrath et al., 1985) includes nine faces ranging from “happiest feeling possible” to “saddest feeling possible”. Children were told that the faces show how a person can feel, and were asked to select the face that best represented how unpleasant or yucky they felt when they had their hand in the water. The scale is scored using affective magnitude ratings assigned to each face ranging from 0.04 to 0.97 (where higher scores indicating higher levels of negative affect), as derived from estimates by children in previous research. This scale has shown good reliability and validity data (P.A. McGrath et al., 1985).

Pain tolerance. To reflect pain tolerance levels, the length of time (in seconds) the child kept their hand immersed in the water was recorded. Tolerance is not a pain measurement strategy usually discussed for use with children, likely due to the lack of lab-induced pain research conducted with children. However, it is a frequently obtained measure among adults and given the relative ease with which it can be obtained, tolerance was included as a measure in the current study.
Facial expression. The Child Facial Coding System (CFCS) codes 13 discrete facial actions adapted from both the Neonatal Facial Coding System (Grunau & Craig, 1987) and the Facial Action Coding System (Ekman & Friesen, 1978). Ten of the 13 facial actions are coded for intensity (range 0-2) (i.e., brow lower, squint, eye squeeze, nasolabial furrow, nose wrinkler, cheek raiser, upper lip raiser, vertical mouth stretch, horizontal mouth stretch, lip corner puller). Intensity is not coded for flared nostril, open lip, and blink. The measure has shown good reliability and validity in the coding of children’s responses to acute pain (Cassidy et al., 1999; Chambers et al., 2000) and longer term postoperative pain (Gilbert et al., 1999). Up to eight 10-second segments were coded for each child (the first 10 seconds after submersion, and up to 7 more 10-second segments at 30-second consecutive intervals from submersion depending on the length of time the child left their hand in the water) by a trained CFCS coder. In this study, a CFCS pain score was obtained for each segment using only those facial actions found to be indicative of pain in previous research (i.e., brow lower, eye squeeze, cheek raiser, nose wrinkler, upper lip raise) (Goodman & McGrath, 1999; Prkachin, 1992). To obtain a CFCS summary score to be entered into the final analyses, a mean score for each of the five facial action across children’s segments was calculated and then the mean scores for each facial action were summed together to yield total CFCS scores with a possible range between 0 and 10. Twenty percent of segments were coded by a second trained CFCS coder. Using Ekman and Friesen’s (1978) reliability formula for facial expression (which involves dividing twice the number of facial actions agreed upon by the total number of facial actions scored by each coder) inter-rater reliability was found to be .86.

Heart rate. Heart rate was measured using a Polar brand heart rate chest band and watch.
An electrode on the backside of the transmitter strap, when moistened, transmits information regarding the number of heartbeats per minute to the watch receiver. Measurements were taken every 5 seconds and, following the measurements, the data were downloaded into a personal computer. A mean heart rate score representing the entire time the child had their hand immersed in the water was calculated.

**Suspiciousness.** Children were asked to rate on a 5-point Likert-type scale ranging from “not at all” to “a lot” the degree with which they had noticed anything “different or weird” about how their mom was acting with them when they had their hand in the water.

**Differences from normal behaviour.** Children were asked to rate on a 5-point Likert-type scale ranging from “not at all” to “a lot” how different they thought their mom was acting with them when they had their hand in the water compared to how their mom normally acts with them when they are hurt or in pain. Mothers were also asked to rate how different they thought their behaviour was from normal.

**Difficulty adhering to the training script.** Mothers in the two training groups also provided ratings on a 5-point Likert-type scale ranging from “not at all” to “a lot” of how difficult it had been to interact with their child in the desired manner.

**Mother verbalizations.** The videotapes of mother-child interactions during the 2-minute waiting period and up to 4-minute pain period were viewed and all parent verbalizations were transcribed by one of three research assistants (Research Assistant #1, n = 28; Research Assistant #2, n = 63; Research Assistant #3, n = 29). A fourth research assistant reviewed all transcriptions and any disagreements regarding the transcribed verbalizations content or breakdown were resolved through discussion. A total of 5,207 parental verbalizations were transcribed, of which n
= 44 (0.85%) were uninterpretable and n = 120 (2.3%) needed to be translated from a foreign language. The parent verbalizations were then coded by a research assistant using the Child - Adult Medical Procedure Interaction Scale - Revised (CAMPIS-R) system developed by Blount and colleagues which has shown excellent reliability and validity data across a number of studies. The CAMPIS-R codes parent-to-child verbalizations into 15 different categories which are then classified into three larger groupings: 1) Coping Promoting (which for the purposes of this study has been re-named to Pain-Reducing) which consists of a) nonprocedural talk to the child, b) commands to use coping strategy, and c) use of humour); 2) Distress Promoting (which for the purposes of this study has been re-named Pain-Promoting) which consists of: a) reassuring comments, b) criticism, c) apologies, d) giving control to the child, and e) empathy; and Adult Neutral which consists of a) commands to engage in a procedural activity, b) praise, c) notice of procedure to come, d) behavioural commands to the child, e) checking the child’s status, f) child’s general condition related talk, and g) current general status comments. The number of verbalizations provided by mothers in each of the categories and groupings were summed for the 2-minute waiting period and the up to 4-minute pain period and then divided by the appropriate number of minutes to yield a rate score reflecting the number of each category and grouping verbalizations provided per minute, for both the waiting and pain periods. Twenty percent of participants' verbalizations were coded by a second coder and percent agreement at the individual code level was calculated to be 87.9% overall (89.2% for the waiting period verbalizations and 87.9% for the pain period verbalizations). Percent agreement at the larger groupings level was 92.2% overall (93.0% for the waiting period and 91.9% for the pain period).
Results

Demographics

The demographic characteristics of the sample, broken down by maternal interaction type and child gender, appear in Table 1. A series of 3 (Maternal Interaction Type) X 2 (Child Gender) analyses of variance (ANOVAs) was used to examine group differences on the continuous measures (e.g., child’s age) and a series of chi square analyses was used to examine group differences on the categorical measures (e.g., child’s ethnicity). Results revealed that there were no significant maternal interaction type or child gender group differences related to any of the demographic measures.

Manipulation Check

The rates with which mothers in each of the three interaction type groups, by child gender, provided pain-promoting, pain-reducing, or neutral verbalizations for both the waiting period and pain period appear in Tables 2 and 3, respectively. A series of 3 (Maternal Interaction Type) X 2 (Child Gender) ANOVAs was used to examine group differences in verbalization use of the CAMPIS categories as a function of maternal interaction type and child gender. Given the number of analyses conducted, to avoid inflated error levels a conservative decision rule was applied, with effects at the $p<.01$ level considered to be significant. As shown in Tables 2 and 3, mothers in the Pain-Promoting Group provided significantly more pain-promoting verbalizations than mothers in the Pain-Reducing Group and mothers in the Control Group, both during the waiting period and the pain period. There were no differences in the number of pain-promoting verbalizations provided by mothers in the Pain-Reducing Group and the Control Group. A statistical examination of the scores for the specific codes (also shown in Tables 2 and 3) within
<table>
<thead>
<tr>
<th></th>
<th>Pain-Promoting Group</th>
<th>Pain-Reducing Group</th>
<th>Control Group</th>
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<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s Age (years)</td>
<td>M = 9.70</td>
<td>M = 9.60</td>
<td>M = 9.65</td>
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<tr>
<td></td>
<td>SD = 1.38</td>
<td>SD = 1.43</td>
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<td></td>
<td>SD = 1.36</td>
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<tr>
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<tr>
<td>White</td>
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<tr>
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<td>n = 3</td>
<td>n = 0</td>
<td>n = 3</td>
</tr>
<tr>
<td>Parent’s Age (years)</td>
<td>M = 42.39</td>
<td>M = 41.90</td>
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<td></td>
<td>SD = 4.50</td>
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<td>Other</td>
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<td>n = 0</td>
<td>n = 1</td>
</tr>
<tr>
<td>Socioeconomic Status (11-77)</td>
<td>M = 28.05</td>
<td>M = 29.35</td>
<td>M = 31.63</td>
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<td></td>
<td>SD = 17.59</td>
<td>SD = 14.40</td>
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<td></td>
<td></td>
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<td>SD = 14.88</td>
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Table 2

Means (and Standard Deviations) for the Rate (per minute) of Type of Maternal Verbalizations by Maternal Interaction Type and Child Gender for the Waiting Period

<table>
<thead>
<tr>
<th></th>
<th>Pain-Promoting Group</th>
<th>Pain-Reducing Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
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<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
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<td>Pain-Promoting Verbalizations</td>
<td>3.05 a</td>
<td>2.20 a</td>
<td>0.80 b</td>
</tr>
<tr>
<td></td>
<td>(2.07)</td>
<td>(1.62)</td>
<td>(0.92)</td>
</tr>
<tr>
<td>Reassurance</td>
<td>2.47 a</td>
<td>1.75 a</td>
<td>0.75 b</td>
</tr>
<tr>
<td></td>
<td>(1.88)</td>
<td>(1.43)</td>
<td>(0.84)</td>
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<tr>
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<td>0.38 a</td>
<td>0.01 b</td>
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<tr>
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<td>(0.56)</td>
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<td>0.00 a</td>
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<td>(0.11)</td>
<td>(0.00)</td>
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<td>0.01 a</td>
<td>0.00 a</td>
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<tr>
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<td>(0.11)</td>
<td>(0.24)</td>
<td>(0.00)</td>
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<td>Criticism</td>
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<td>0.00 a</td>
<td>0.00 a</td>
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<td>(0.00)</td>
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<td>8.60 b</td>
</tr>
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<td></td>
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<td>(2.72)</td>
<td>(3.13)</td>
</tr>
<tr>
<td>Non-procedural talk</td>
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<td>3.67 a</td>
<td>6.95 b</td>
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<td>(2.97)</td>
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<td>0.50 b</td>
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<td>(0.83)</td>
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<td>1.00 a</td>
<td>1.15 a</td>
</tr>
<tr>
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<td>(0.70)</td>
<td>(1.46)</td>
<td>(1.31)</td>
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<td>1.25&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
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<td>(1.86)</td>
<td>(1.41)</td>
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<td>0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.35)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Praise</td>
<td>0.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.18&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.01&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
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<td>(0.29)</td>
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<td>(0.24)</td>
</tr>
<tr>
<td>Notice of procedure to come</td>
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<td>0.45&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>(0.79)</td>
<td>(0.86)</td>
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<td>0.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.20&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>(0.29)</td>
<td>(0.38)</td>
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<td>1.63&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.50&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>(1.13)</td>
<td>(1.50)</td>
<td>(0.67)</td>
</tr>
<tr>
<td>General condition talk</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>General status talk</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>(0.00)</td>
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</tr>
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</table>

**Note.** Means in the same row with different superscripts differ at p<.01 or better.
Table 3

Means (and Standard Deviations) for the Rate (per minute) of Type of Maternal Verbalizations by Maternal Interaction Type and Child Gender for the Pain Period

<table>
<thead>
<tr>
<th></th>
<th>Pain-Promoting Group</th>
<th></th>
<th>Pain-Reducing Group</th>
<th></th>
<th>Control Group</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td></td>
<td>Girls</td>
<td></td>
<td>Boys</td>
<td></td>
</tr>
<tr>
<td>Pain-Promoting Verbalizations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(Pain-Promoting Group)</td>
<td>5.63 (^a)</td>
<td>4.90 (^a)</td>
<td>1.18 (^b)</td>
<td>1.40 (^b)</td>
<td>2.38 (^b)</td>
<td>1.84 (^b)</td>
</tr>
<tr>
<td>(Verbalizations)</td>
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<td>(3.31)</td>
<td>(1.26)</td>
<td>(1.47)</td>
<td>(2.11)</td>
<td>(1.76)</td>
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<tr>
<td>Reassurance</td>
<td>2.83 (^a)</td>
<td>2.97 (^a)</td>
<td>0.75 (^b)</td>
<td>0.94 (^b)</td>
<td>0.72 (^b)</td>
<td>0.85 (^b)</td>
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<tr>
<td>(Boys)</td>
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<td>(2.28)</td>
<td>(1.01)</td>
<td>(1.23)</td>
<td>(0.92)</td>
<td>(1.04)</td>
</tr>
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<td>(Girls)</td>
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<td></td>
<td></td>
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<tr>
<td>Giving Control</td>
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<td>0.87 (^a)</td>
<td>0.40 (^b)</td>
<td>0.38 (^b)</td>
<td>1.49 (^a)</td>
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<td>(0.79)</td>
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<td>(1.87)</td>
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<td>(Girls)</td>
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<td></td>
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<tr>
<td>Apologies</td>
<td>0.28 (^a)</td>
<td>0.15 (^a)</td>
<td>0.00 (^b)</td>
<td>0.01 (^b)</td>
<td>0.01 (^b)</td>
<td>0.00 (^b)</td>
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<tr>
<td>(Boys)</td>
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<td>(Girls)</td>
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<tr>
<td>Empathy</td>
<td>1.10 (^a)</td>
<td>0.87 (^a)</td>
<td>0.00 (^b)</td>
<td>0.01 (^b)</td>
<td>0.16 (^b)</td>
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<td>(0.00)</td>
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<td>(Girls)</td>
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<td></td>
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<tr>
<td>Criticism</td>
<td>0.00 (^a)</td>
<td>0.01 (^a)</td>
<td>0.01 (^b)</td>
<td>0.00 (^a)</td>
<td>0.00 (^a)</td>
<td>0.00 (^a)</td>
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<tr>
<td>(Girls)</td>
<td></td>
<td></td>
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<td>Pain-Reducing Verbalizations</td>
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<td></td>
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<td></td>
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<tr>
<td>(Pain-Reducing Group)</td>
<td>1.46 (^a)</td>
<td>1.86 (^a)</td>
<td>8.72 (^b)</td>
<td>8.79 (^b)</td>
<td>3.91 (^c)</td>
<td>3.98 (^c)</td>
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<td>(3.76)</td>
<td>(3.58)</td>
<td>(2.15)</td>
<td>(2.30)</td>
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<tr>
<td>Non-procedural talk</td>
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<td>0.55 (^a)</td>
<td>3.30 (^b)</td>
<td>3.63 (^b)</td>
<td>1.55 (^c)</td>
<td>1.98 (^c)</td>
</tr>
<tr>
<td>( Boys)</td>
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<td>(0.87)</td>
<td>(2.90)</td>
<td>(3.05)</td>
<td>(2.24)</td>
<td>(2.15)</td>
</tr>
<tr>
<td>(Girls)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suggestions on how to cope</td>
<td>0.01 (^a)</td>
<td>0.10 (^a)</td>
<td>3.21 (^b)</td>
<td>2.84 (^b)</td>
<td>0.45 (^a)</td>
<td>0.40 (^a)</td>
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<tr>
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<td>(0.21)</td>
<td>(2.66)</td>
<td>(2.11)</td>
<td>(0.72)</td>
<td>(0.62)</td>
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<td>(Girls)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humour</td>
<td>1.06 (^a)</td>
<td>1.21 (^a)</td>
<td>2.22 (^b)</td>
<td>2.32 (^b)</td>
<td>1.91 (^a)</td>
<td>1.60 (^a)</td>
</tr>
<tr>
<td>(Boys)</td>
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<td>(1.52)</td>
<td>(2.21)</td>
<td>(2.83)</td>
<td>(1.93)</td>
<td>(1.12)</td>
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<td>Mean 1</td>
<td>Mean 2</td>
<td>Mean 3</td>
<td>Mean 4</td>
<td>Mean 5</td>
<td>Mean 6</td>
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<td>5.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.54&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.30&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.53&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.99&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Command for procedural activity</td>
<td>0.90&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.97&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.57&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.08&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>0.96&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.14&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.10&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Notice of procedure to come</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
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<td>Behavioural command to the child</td>
<td>0.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.14&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.21&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Checking the child's status</td>
<td>2.76&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.29&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.29&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.46&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.60&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>General condition talk</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>General status talk</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note. Means in the same row with different superscripts differ at p<.01 or better.

the more general pain-promoting category revealed that the group differences could be attributed primarily to differences in the use of reassurance and giving control during the waiting period, and the use of reassurance, apologies, and empathy during the pain period. Mothers in the Pain-Promoting Group did not differ from other mothers in their use of criticism, empathy, or apologies during the waiting period. Further, mothers in the Pain-Promoting Group did not differ from other mothers in their use of giving control and criticism during the pain period.
Mothers in the Pain-Reducing Group provided more pain-reducing verbalizations than mothers in the Control Group, who in turn provided more pain-reducing verbalizations than mothers in the Pain-Promoting Group, both during the waiting period and pain period. A statistical examination of the scores for the specific codes (also shown in Tables 2 and 3) within the more general pain-reducing category revealed that the group differences could be attributed primarily to differences in the use of non-procedural talk and suggestions on how to cope during the waiting period, and the use of all three pain-reducing codes during the pain period. Mothers in the Pain-Reducing Group did not differ from other mothers in their use of humour during the waiting period.

There was a significant group difference for use of neutral verbalizations during the waiting period, where mothers in the Pain-Promoting Group provided more neutral verbalizations, in the form of praise and checking the child’s status, than mothers in the Pain-Reducing or Control Groups. Analyses revealed that there were no group differences in maternal verbalizations as a function of child gender during either the waiting or pain period.

The mean score for children’s rating of whether they had noticed anything “weird or different” about how their mom had interacted with them, by maternal interaction type and child gender, appear in Table 4. The overall mean for child-rated suspiciousness was quite low, 0.69 (SD = 1.19) on a 0 to 4 scale. A 3 (Maternal Interaction Type) X 2 (Child Gender) ANOVA revealed no significant differences in children’s suspiciousness ratings as a function of maternal interaction group and child gender.

The mean ratings provided by mothers and children for how different mothers had been acting compared to how they normally would act when their child was in pain are also presented
Table 4

Means (and Standard Deviations) of Children’s Suspiciousness of their Mothers’ Behaviour,
Differences in Maternal Behaviour, and Mother Ratings of Difficulty Adhering to the Training Script

<table>
<thead>
<tr>
<th></th>
<th>Pain-Promoting Group</th>
<th>Pain-Reducing Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Child rating of suspiciousness (0 - 4)</td>
<td>0.70</td>
<td>1.10</td>
<td>0.35</td>
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<td></td>
<td>(1.08)</td>
<td>(1.62)</td>
<td>(0.75)</td>
</tr>
<tr>
<td>Child rating of difference from typical maternal behaviour (0 - 4)</td>
<td>1.20</td>
<td>2.15</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>(1.11)</td>
<td>(1.50)</td>
<td>(1.50)</td>
</tr>
<tr>
<td>Mother rating of difference from typical maternal behaviour (0 - 4)</td>
<td>1.40</td>
<td>1.30</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>(1.31)</td>
<td>(1.13)</td>
<td>(1.21)</td>
</tr>
<tr>
<td>Mother rating of difficulty adhering to training script (0 - 4)</td>
<td>0.45</td>
<td>0.70</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>(0.76)</td>
<td>(0.86)</td>
<td>(0.99)</td>
</tr>
</tbody>
</table>

Note. All ratings were provided on a 5 point Likert type rating scale ranging from 0 = not at all to 4 = a lot.

in Table 4. The overall mean for difference from normal behaviour was reasonably low, child rating: 1.38 (SD = 1.30), and mother rating: 1.38 (SD = 1.31), on a possible 0 to 4 scale. A set of 3 (Maternal Interaction Type) X 2 (Child Gender) ANOVAs using child ratings and then mother ratings revealed no significant differences in ratings of differences from normal behaviour as a function of maternal interaction group and child gender.
The mean ratings provided by mothers when asked how difficult it had been for them to interact in the desired manner also appear in Table 4. The overall mean for difficulty was quite low, 0.55 (SD = 0.87) on a possible 0 to 4 scale. A 2 (Maternal Interaction Type) X 2 (Child Gender) ANOVA revealed no significant differences in mothers’ difficulty ratings as a function of maternal interaction group and child gender.

In summary, these analyses indicate that the experimental manipulation was generally successful in varying in the desired manner the types of maternal verbalizations offered during the waiting period and pain period of the cold pressor task, depending on what group the mothers had been randomly assigned to. Summaries of maternal verbalizations, by group, for the waiting period and pain period, are depicted graphically in Figures 1 and 2, respectively. It is noted that, on average, mothers in both of the training groups considerably exceeded the 1.5 verbalizations per minute minimum from their assigned interaction type that had been suggested during their training.

Relationship Among the Dependent Measures

To assess the degree of convergence among the various dependent measures and to enable decisions to be made regarding the structure of subsequent statistical analyses, correlational analyses (Pearson product moment correlation coefficients) were conducted and are presented in Table 5. As can be seen from the Table, consistent with previous research (Goodenough et al., 1997), the self-report pain intensity and affect measures were moderately correlated; children who reported higher levels of pain intensity during the cold pressor also reported higher levels of negative affect during the cold pressor. Not surprisingly, pain tolerance was negatively correlated with the self-report pain intensity and affect measures; children who
Figure 1. Maternal Verbalization Use (rate per minute) as a Function of Maternal Interaction Type Group during the Waiting Period

Figure 2. Maternal Verbalization Use (rate per minute) as a Function of Maternal Interaction Type Group during the Pain Period
Table 5

Correlations between the Various Dependent Measures and Child Age

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Pain Tolerance</th>
<th>Pain Intensity</th>
<th>Pain Affect</th>
<th>Heart Rate</th>
<th>CFCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Pain Tolerance</td>
<td>.10</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Pain Intensity</td>
<td>.19*</td>
<td>-.34**</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Pain Affect</td>
<td>.18*</td>
<td>-.29**</td>
<td>.45**</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Heart Rate</td>
<td>-.11</td>
<td>.03</td>
<td>-.03</td>
<td>.01</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>CFCS</td>
<td>.01</td>
<td>-.17</td>
<td>-.03</td>
<td>-.01</td>
<td>-.04</td>
<td>---</td>
</tr>
</tbody>
</table>

Note. CFCS = Child Facial Coding System; *p<.05; **p<.01

reported higher levels of pain intensity and negative affect during the cold pressor removed their hand from the cold pressor sooner than children who reported lower levels of pain intensity and affect. Scores on the physiological measure (heart rate) and the behavioural measure (CFCS) were not related, and were not significantly correlated with the self-report or pain tolerance measures.

Child age was significantly correlated with the two self-report measures, albeit the direction of the correlation was in contrast to previous findings (Chambers & Craig, 1998; Goodenough et al., 1997). Younger children reported lower levels of pain intensity and negative
affect than older children.

**Primary Analyses**

Analyses involving the self-report and pain tolerance measures. The means and standard deviations of children’s scores on each of the dependent measures, as a function of maternal interaction type and child gender, appear in Table 6. Given the significant relationships among the two self-report measures and pain tolerance, these three measures were entered together into a 3 (Maternal Interaction Type) X 2 (Child Gender) multivariate analysis of covariance (MANCOVA), with Child Age entered as a covariate given the significant relationship between child’s age and the two self-report measures (Tabachnick & Fidell, 1996). Wilks’ lambda was used as the multivariate test as it has good power and is the traditional test recommended for use in multivariate analyses (Tabachnick & Fidell, 1996).

The MANCOVA yielded a significant multivariate main effect for Maternal Interaction Type, $F(6, 222) = 2.84, p = .01$, and a significant multivariate interaction effect between Maternal Interaction Type and Child Gender, $F(6, 222) = 2.18, p<.05$. Child Age as a covariate was also significant, $F(3, 111) = 4.04, p<.01$. The multivariate main effect of Child Gender was not significant, $F(3, 111) = 1.47, p>.05$.

A series of follow-up 3 (Maternal Interaction Type) X 2 (Child Gender) univariate analyses of covariance (ANCOVAs), with Child Age as a covariate was conducted to probe the significant multivariate effects. There were no significant main effects or interactions when pain tolerance or pain affect were used as the dependent variables. When self-reported pain intensity was used as the dependent variable there was a significant main effect for Maternal Interaction Type, $F(2, 113) = 3.97, p<.05$. However, this main effect was superseded by a significant
Table 6

Means (and Standard Deviations') of Scores on the Various Dependent Measures as a function of Maternal Interaction Type and Child Gender

<table>
<thead>
<tr>
<th></th>
<th>Pain-Promoting Group</th>
<th>Pain-Reducing Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Pain Intensity</td>
<td>3.55</td>
<td>4.40</td>
<td>3.65</td>
</tr>
<tr>
<td></td>
<td>(1.82)</td>
<td>(1.27)</td>
<td>(1.73)</td>
</tr>
<tr>
<td>Pain Affect</td>
<td>0.55</td>
<td>0.68</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>(0.27)</td>
<td>(0.22)</td>
<td>(0.22)</td>
</tr>
<tr>
<td>Pain Tolerance</td>
<td>128.60</td>
<td>163.70</td>
<td>113.35</td>
</tr>
<tr>
<td></td>
<td>(95.61)</td>
<td>(98.02)</td>
<td>(96.66)</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>94.32</td>
<td>89.24</td>
<td>94.67</td>
</tr>
<tr>
<td></td>
<td>(9.08)</td>
<td>(12.18)</td>
<td>(9.31)</td>
</tr>
<tr>
<td>CFCS</td>
<td>2.06</td>
<td>1.08</td>
<td>1.98</td>
</tr>
<tr>
<td></td>
<td>(1.24)</td>
<td>(0.50)</td>
<td>(1.04)</td>
</tr>
</tbody>
</table>

Note. CFCS = Child Facial Coding System

interaction effect between Maternal Interaction Type and Child Gender, $F(1, 113) = 3.94, p<.05$. This interaction effect is depicted in Figure 3. The main effect for Child Gender was not significant, $F(1, 113) = 0.39, p>.05$. Child Age was a significant covariate when self-reported pain intensity and pain affect were used as dependent measures, $F(1, 113) = 5.77, p<.05$, and $F(1, 113) = 4.31, p<.05$, respectively.

Given that the Maternal Interaction Type X Child Gender interaction was significant
when using self-reported pain intensity as the dependent measure, two separate one-way
ANCOVAs examined differences as a function of maternal interaction type separately for boys and for girls. For boys, there were no significant differences in self-reported pain intensity as a function of Maternal Interaction Type, $F(2, 56) = 0.48$, $p>.05$. Age was not a significant covariate, $F (1, 56) = 2.24$, $p>.05$. However, for girls there was a highly significant effect of Maternal Interaction Group, $F(2, 56) = 10.98$, $p<.001$. Age was a significant covariate, $F (1, 56) = 4.15$, $p<.05$. As illustrated in Figure 3, follow-up Student-Newman-Keuls post-hoc testing revealed that girls of mothers in the Pain-Promoting Group reported higher levels of pain intensity than girls of mothers in the Control Group, who in turn reported higher levels of pain.
intensity than girls of mothers in the Pain-Reducing Group.

In summary, as hypothesized, the analyses indicated that there was a significant effect of maternal interaction type when controlling for the effects of age, but only for girls in the sample and only when using self-reported pain intensity as the dependent measure. In contrast to hypotheses, maternal interaction type did not have an effect on children’s self-reported pain affect or the length of time they left their hand in the water. Also in contrast to hypotheses, there were no gender differences in children’s scores on the pain intensity, affect, or tolerance measures.

Analyses involving the behavioural and physiological measures. A 3 (Maternal Interaction Type) X 2 (Child Gender) ANOVA was used to examine differences in children’s CFCS scores as a function of maternal interaction type and gender. Results indicated a significant main effect of Child Gender, F(1, 114) = 11.25, p<.01. However, the direction of the result was in contrast to hypotheses; boys had significantly higher CFCS scores than girls. The main effect of Maternal Interaction Type, and the interaction between Maternal Interaction Type and Child Gender, were not significant, F(2, 114) = 2.42, p>.05, and F(2, 114) = 2.07, p>.05, respectively.

An additional 3 (Maternal Interaction Type) X 2 (Child Gender) ANOVA was used to examine differences in children’s heart rate scores as a function of maternal interaction type and gender. Results indicated no significant main effects for Maternal Interaction Type, F(2, 114) = 0.55, p>.05, Child Gender F(1, 114) = 0.56, p>.05, or interaction between Maternal Interaction Type and Child Gender, F(2, 114) = 1.04, p>.05.

In summary, in contrast to hypotheses, there were no differences in children’s CFCS and heart rate scores as a function of maternal interaction type. Further, there was an unexpected
gender differences in children’s CFCS scores, where boys had higher scores on this measure than girls. There was no gender difference in children’s heart rate scores.

Discussion

Both clinicians and researchers in the field of pediatric pain frequently attribute an important role to parents’ actions as determinants of their children’s pain experiences and behaviour. In contrast, empirical knowledge regarding parental contributions has been limited due to inadequacies of research methodologies employed. The present study provided a systematic examination of maternal influences on children’s pain experiences through the use of a lab-based experimental design allowing explicit statement to be made regarding the causal role of maternal behaviour. Mothers of healthy pain-free children were randomly assigned and trained to interact verbally with their children in one of three ways during a lab-induced cold pressor pain paradigm: 1) pain-promoting interaction; 2) pain-reducing interaction; and 3) natural interaction (no training control group). The pain-promoting and pain-reducing labels were used to represent the hypothesized direction of maternal effects. The impact of interaction type on children’s pain experiences was measured by children’s self-reports of pain intensity and pain affect, pain tolerance, detailed coding of the children’s videotaped facial responses, and heart rate responsiveness during the cold pressor task.

Effectiveness of the Manipulation of Mothers’ Verbal Behaviour

A four-step training procedure, consisting of verbal instruction, video-taped demonstration, role-played practice, and written reminders, was used to manipulate mothers’ verbal behaviour into primarily a pain-promoting or pain-reducing manner. The manipulation check of the content of mothers’ verbalizations revealed that the manipulation was successful.
Mothers in the pain-promoting group provided significantly more verbalizations believed to be pain-promoting than mothers in the pain-reducing group and mothers in the control group. The lack of differences in the number of pain-promoting verbalizations provided by mothers in the pain-reducing group and the control group can likely be attributed to the low rate with which mothers in the control group provided pain-promoting verbalizations. Group differences could be attributed primarily to differences in the use of reassurance and giving control during the waiting period, and the use of reassurance, apologies, and empathy during the pain period. The predominant use of reassurance by mothers in the pain-promoting group is consistent with previous research examining the frequency of occurrence of the various pain-promoting CAMPIS codes (Blount et al., 1989). Mothers in the pain-promoting group did not differ from other mothers in their use of criticism, empathy, or apologies during the waiting period. Further, mothers in the pain-promoting group did not differ from other mothers in their use of giving control and criticism during the pain period. It may have seemed uncomfortable and inappropriate for mothers in the pain-promoting group to provide empathy or apology verbalizations prior to their child actually putting their hand in the water. Further, it appears to have been very difficult for mothers in the pain-promoting group to openly criticize their child during the experimental session, perhaps because they knew their verbalizations were being recorded by the experimenters. The lack of a significant difference in mothers' use of control during the pain period is likely due to the fact that, because of ethical constraints, mothers in all three groups were instructed that they could remind their child that they could take their hand out of the water at any time if the child asked them (a verbalization that would be coded as giving control).
Mothers in the pain-reducing group provided more pain-reducing verbalizations than mothers in the control group, who in turn provided more pain-reducing verbalizations than mothers in the pain-promoting group, both during the waiting period and pain period. Group differences could be attributed primarily to differences in the use of non-procedural talk and suggestions on how to cope during the waiting period, and the use of all three pain-reducing codes during the pain period. Mothers in the pain-reducing group did not differ from other mothers in their use of humour during the waiting period. This seems to have occurred because mothers in all three groups engaged in some level of joking behaviour or humour with their child while they were waiting, perhaps out of nervousness or an attempt to feel more comfortable in a somewhat novel and unique situation.

There was an unexpected significant group difference for use of neutral verbalizations during the waiting period, where mothers in the pain-promoting group provided more neutral verbalizations than mothers in the pain-reducing or control groups. Group differences could be attributed to differences in maternal use of praise and checking the child’s status during the waiting period, and the use of praise during the pain period. An examination of the videotapes and coded transcriptions revealed that some mothers in the pain-promoting group occasionally provided what they may have thought would be reassuring statements, but actually better met the coding criteria for praise (e.g., “You’re doing a great job”) or checking the child’s status (e.g., “You’re doing okay, right?”).

Mothers in all three groups used verbalization types in the same way, regardless of whether their child was a boy or a girl. In terms of suspiciousness, children of the mothers in the two training groups were no more suspicious of their mothers than children of mothers in the
control group who had not received any training and had been instructed to interact with their children in the way they normally would. Further, mothers in the two training groups reported a similar level of difference from their typical behaviour. This finding was corroborated by the children’s ratings. In fact, mothers in the training groups did not differ in their ratings from mothers in the control group, who had not been instructed to behave in a different matter. It seems likely that any marked differences from typical behaviour reported by mothers and children can be attributed to the unique and novel nature of this pain situation, rather than constraints imposed on them by the training procedure. The effectiveness of the manipulation of the mothers’ verbal behaviour is supported by the fact that mothers indicated low levels of difficulty adhering to the desired training scripts and this did not vary as a function of the group they had been randomly assigned to or the gender of their child. In addition to varying maternal verbalizations in the desired manner, it is noted that the cold pressor was successful in creating levels of pain intensity in the children which would be classified as clinically significant based on previous research using the same self-report measure (Gauthier et al., 1998).

In summary, the pattern of findings indicated that the experimental manipulation was generally successful in varying in the desired manner the types of maternal verbalizations offered during the waiting period and pain period of the cold pressor task, depending on what group the mothers had been randomly assigned. As presented in Figures 1 and 2, it appears to have been difficult for mothers in the two training groups to refrain from saying verbalization types that they had been asked to restrict during the waiting period; however, during the pain period mothers appear to have been much more compliant with this request and produced verbalizations that were primarily from their assigned interaction type, in addition to some neutral
verbalizations. The low levels of suspiciousness reported by children, the low ratings of difficulty reported by mothers, and the low levels of differences from typical maternal behaviour endorsed by both mothers and children indicate that children were not aware or suspicious of the manipulation of their mothers' verbal behaviour, and that adhering to the training scripts was perceived as relatively easy by the mothers during the painful cold pressor procedure. This experimental manipulation of mothers’ behaviours appears to have been much more successful then a previous attempt described in the literature (Gonzalez et al., 1993), perhaps due to the fact that this was not a medical situation and consequently was perceived by mothers to be a less stressful experience, allowing them to more freely adhere with their assigned training script.

Maternal Effects on Children’s Self-Reported Pain Intensity

Given the success with which mothers adhered to the training scripts and were able to vary their verbal behaviour in the desired manner, it follows to consider what effects the manipulation had on children’s pain experiences during the cold pressor. As hypothesized, when controlling for the effects of age, girls whose mothers interacted with them in a manner that was expected to be pain-promoting reported higher levels of worst pain intensity during the cold pressor than girls whose mothers were in the control group, who in turn reported higher levels of worst pain intensity during the cold pressor than girls whose mothers had interacted with them in a pain-reducing manner. This finding is consistent with prior correlational research examining the relationship between certain kinds of parental behaviours and child distress (Blount et al., 1989; Walker & Zeman, 1992). However, this research builds on the previous correlational findings, indicating that maternal behaviour can have a direct effect on their daughters’ subjective reports of pain, and not simply the more general construct of distress (Blount et al.,
It is interesting to consider reasons why maternal interaction type only had an effect on girls’, not boys’, self-reports of worst pain intensity. Prior research has indicated that girls may be more aware of and sensitive to their parents’ behaviour regarding pain and illness symptoms (Walker & Zeman, 1992). Therefore it was possible that the girls in this study were simply more aware of, and hence reactive to, their mothers’ behaviour during the cold pressor as compared to the boys. There is evidence from the adult literature that females have greater interpersonal awareness and sensitivity than males (Chaffin, Crawford, Herrmann, & Deffenbacher, 1985), and research from a developmental perspective has found that girls are more aware of empathic cues provided by others than boys (Strayer & Roberts, 1997). Taken together, this previous research indicates that it is possible that heightened interpersonal awareness during the cold pressor enabled the girls in this study to detect and be influenced more readily by their mothers’ behaviour.

It is also interesting to consider whether the pain responses of the 8- to 12-year-old boys who participated in this study had already been well socialized, and therefore were not as susceptible to maternal influence as the responses of the girls. Unfortunately, the research literature has only begun to explore gender differences in children’s pain experiences, with no empirical knowledge to date to support that boys’ pain responses are socialized at an earlier age than girls’. However, it seems plausible that, from an early age, boys may be more likely to receive strong messages from their parents regarding the acceptability of displays of pain, and perhaps the manipulation of mothers’ behaviour in the current study was not strong enough to overthrow these powerful prior learning experiences. Clearly, future research is needed to
examine maternal influences on children's pain responses at a younger age (e.g., 4- to 8-year-olds) in order to more deeply explore the developmental course of gender differences in maternal influences on children’s pain experiences.

When considering what primarily constituted the pain-promoting interaction, it was clear that the most common verbalization type used by mothers was reassurance, followed by low frequency use of apologies and empathy during the pain period. Similarly, when considering the pain-reducing interaction, the most common verbalization type used by mothers was non-procedural talk (i.e., distraction), followed by suggestions on how to cope and the use of humour. Despite some recent controversy in the adult health psychology literature regarding the role of distraction in the management of pain (Leventhal, 1992), there is a long history of empirical evidence and theory in the pediatric psychology literature supporting the notion that distraction, by focusing attention away from the pain through non-procedural talk or the use of humour, and providing children with concrete suggestions on how they can cope with their pain, are effective methods of preventing and diminishing pain complaints (Holden, Deichmann, & Levy, 1999; Powers, 1999). However, there has been relatively little critical consideration of the mechanisms through which parental verbalizations such as reassurance, apologies, and empathy might be related to increased levels of pain and distress in children.

One possibility is that parental reassurance, indicating empathic agreement, and behaving in an apologetic manner may occur primarily in response to child distress and simply reinforce children's displays of distress and pain. However, previous research has indicated that, while parental reassurance and other pain-promoting behaviours do take place during and after a child’s distress vocalizations, they also frequently occur prior to a child exhibiting any signs of pain and
distress (Blount et al., 1990), and the results of the current study indicate that maternal use of reassurance, empathy, and apologies had a direct effect on girls' subjective reports of pain. Therefore, another possibility is that, consistent with a social learning perspective (Bandura, 1977; Craig, 1983), parental use of reassurance, empathy, and apologies, may first function as a signal that the parent feels anxious or concerned. Perhaps the verbal reactions are accompanied by a fearful parental facial expression or tone of voice, that also precipitates children's behavioural distress, further serving to reinforce the children's pain and distress behaviour as the interaction progresses. A quotation from a recent Newberry award winning children's novel seems to support this view: "If an adult tells you not to worry, and you weren't worried before, you better hurry up and start because you're already running late." (Curtis, 1999, p. 42).

Unfortunately, because mothers in the pain-promoting group engaged in all three of reassurance, empathy, and apologies, knowledge regarding the specific influence of each of these behaviours, in isolation of one another, is limited. Clearly, additional research is needed to more systematically examine how reassurance and other pain-promoting behaviours work to produce elevated levels of pain and distress in children. Regardless, the results of the current study indicate that parental use of reassurance, apologies, and empathy can play a direct role in influencing girls' subjective reports of painful experiences.

Maternal Effects on the Other Pain Measures

In contrast to hypotheses, there were no group differences as a function of maternal interaction type on children's self-reports of pain affect, pain tolerance, facial reactivity, and physiological reactivity. It is noted that when supplementary analyses were conducted with children's highest CFCS and heart rate scores during the pain period entered into the analyses as
the dependent variables rather than the average scores (to reflect the “worst” score, similar to the self-report of pain intensity), there were also no significant findings. One possible explanation for the lack of significant differences on these measures is that behavioural, physiological, and emotional reactions to pain are generally regarded as more deeply entrenched and less subjective to external influences than self-reports of pain intensity (Craig, 1998). Indeed, if the long term impact of socialization and parental influences were as powerful as has been suggested (Blount et al., 1989; Walker & Zeman, 1992), it is impressive that a time-limited 6 minute or less experimental session could override a lifetime of learned parent-child interactions surrounding pain and illness symptoms and have an effect on at least one component of the children’s pain experience.

The finding from this study of a maternal interaction effect on children’s self-reported pain intensity, and not facial reactivity, stands in stark contrast to the study conducted by Goodman and McGrath (1999). In their study, children observed their parents engage in a cold pressor task while displaying either an exaggerated behavioural reaction to the pain or a stoic response. Results showed that children who had observed their parents demonstrate an exaggerated response to the pain had significantly higher scores on the CFCS facial reactivity measure, but not the self-report measure, during the cold pressor than the children who had observed their parents demonstrate a stoic response. Given that the measures used in the study by Goodman and McGrath (1999) were identical to the measures used in the current study, it is interesting to consider what might account for the different pattern found with the dependent measures. The most striking difference between the two studies was with respect to how the information regarding the pain experiences was transmitted from parents to children. In the study
by Goodman and McGrath, parents communicated information regarding the experience to their children in a non-verbal format (e.g., through the use of facial grimacing), whereas parents in the current study communicated information regarding the experience in a verbal format (e.g., through the use of different types of verbalizations). Perhaps children first learn to respond to pain symptoms in a modality specific to how the information about the experience was initially transmitted to them from their parents. That is, children who receive non-verbal information first react to the learning experience with non-verbal pain responses (e.g., facial reactivity), whereas children who receive verbal information first react through their verbal pain responses (e.g., self-report of pain intensity). Additional research is needed to more systematically address this fascinating issue.

There are other potential explanations for the lack of significant differences on the other pain measures. An anecdotal observation from this study was that some children appeared much more susceptible to their mothers’ verbal behaviour and were easier to influence than others. On several occasions we observed mothers who did an excellent job adhering to their assigned training script, but whose children seemed to rely more on their internal coping resources than the external information provided by their mothers. For example, one child who, in reaction to his mother’s reassuring statements, said “It’ll be fine. I’ll just need to try to think about something else. I can do this.” As reviewed previously, there are many psychological variables that contribute to individual differences in children’s pain experience, and it seems very likely that individual differences in children’s coping skills (Reid et al., 1998) or their pain-sensitive temperament (Chen et al., 2000) might predispose some children to rely more heavily on external resources such as parents, whereas other children might draw more from internal resources.
Significant findings on the behavioural and physiological measures, as a function of maternal interaction type, may have been masked by the variability introduced by individual difference variables such as those listed above. Additional research is needed to examine what child individual difference factors might moderate the relationship between maternal behaviour and children’s pain responses.

**Relationships Among the Pain Measures**

In the present study there was a lack of congruence among the self-report, behavioural, and physiological measures. This is not entirely surprising, given previous accounts of discordance among multiple measures of pain in children (Beyer et al., 1990). This finding is consistent with a tripartite view of other emotional and psychological states, such as anxiety (Rachman, 1989), and likely reflects the complex nature of the pain experience. As pain is a subjective state, self-reports are generally considered to be the “gold standard” in pain assessment (Merskey & Bogduk, 1994), in which case more emphasis would be placed on the findings based on self-report in this study. However, the notion that self-report should be given a priority over non-verbal measures of pain in children has recently been challenged (Anand & Craig, 1996; Craig 1992), and researchers investigating parental influences in pediatric pain in the future should continue to incorporate multiple measures of pain to provide a complete picture regarding children’s pain experiences.

An important distinction should be drawn between pain *experience* and pain *expression*. Pain measurement strategies typically assess levels of pain expression (e.g., facial expressivity), and the information from these measures is inferred to provide information regarding an individual’s pain experience. However, all measures are limited in their ability to provide a
comprehensive evaluation of an individual’s pain experience, which is a highly individualized and subjective event. The inclusion of multiple measures of pain expression, some of which may overlap somewhat but tap at only part of the construct of pain is one way of increasing the likelihood that children’s pain expressions accurately reflect their inner pain experiences.

**Gender And Age Differences in Children’s Pain Responses**

In the present study, there were no gender differences in children’s self-reports of pain intensity or pain affect, the length of time their left their hand in the water, or their heart rate responsiveness during the cold pressor. The majority of research examining gender differences in pain experiences had been conducted with adults, and has revealed a fairly robust finding of females reporting greater levels of pain intensity and frequency than males (Unruh, 1996). The results of research examining gender differences among children’s pain experiences has yielded mixed results, with some studies indicating that girls report more pain than boys (Chambers et al., 1999; Goodenough et al., 1997), but other studies reporting no such differences (Fowler-Kerry & Lander, 1991). It may be that gender differences in pain experience gradually emerge over the course of growing up, only to be fully evident in adulthood. A result that was somewhat surprising was the finding that boys in this study had significantly higher CFCS scores during the cold pressor then girls. Previous research examining gender differences in children’s behavioural responses to pain has been conducted with the children’s knowledge that they were being watched and their behaviour recorded (Chambers et al., 1999; Goodenough et al., 1997). It is possible that a different pattern of gender differences in behavioural pain reactivity occurs when children are unaware that their behaviour is being watched except by their mothers, as in the case of this study. Indeed, research examining audience effects among adults during painful
procedures has indicated that an attenuation of responses does take place (Kleck et al., 1976) and it seems likely that this might especially be the case for boys who might want to appear “tough” when being watched by experimenters or observers. In support, research from a developmental perspective confirms that children do report that they vary or control their emotional expression more in the presence of certain audiences (e.g., peers) than others (e.g., parents) (Zeman & Garber, 1996). In addition, it was anecdotally observed in this study that the boys seemed to be more surprised than the girls with respect to how painful the cold pressor actually was. This surprise may have resulted in an increased level of facial reactivity related to pain. Additional research is needed to more systematically examine gender differences on the various dimensions of children’s pain experiences, in the presence and absence of, an observing audience.

As expected, age of the child was significantly correlated with their self-reports of pain intensity and affect; however, the direction of the relationship was opposite to what was hypothesized and in contrast to previous research examining age differences in children’s pain expression which has founded decreasing reports and displays of pain with increasing age of the child (Fradet et al., 1990; Lander & Fowler-Kerry, 1991; Goodenough et al., 1997). Younger children in this study reported less pain intensity and less negative affect during the cold pressor than older children. The previous research that has found decreasing reports of pain intensity with increasing child age has generally categorized children in the 8- to 12-year-old age range together and compared them to younger (e.g., 5- to 7-year-olds) and older (e.g., 13-to 15-year-olds). Therefore, specific knowledge regarding age differences within the 8- to 12-year-old age range has not been previously established. It could be that within this age group pain actually increases with increasing age of the child. However, it was interesting that this relationship was
present only when considering the self-report measures and not the behavioural or physiological measures. Recent research has indicated that young school-aged children experience difficulty accurately using rating scales and tend to respond at the extremes ends of rating scales when compared to older school-aged children (Chambers & Johnston, in press). Therefore the finding of a higher score on the self-report measure may simply be an artifact of a different response style among the younger children in this study.

Implications for Theory

Social learning theory states that many complex human behaviours are learned through a combination of verbal transmission of information and observation of a skilled model (Bandura, 1971), and the application of social learning theory to the etiology and maintenance of children’s pain rests on several learning mechanisms, including social modeling of pain responses by significant others in the family, parental reinforcement of children’s pain responses, and direct verbal instruction on how to feel or behave when in pain (Craig, 1983, 1986). In recent years empirical evidence has begun to build support for various components of this model, including the body of research indicating that social modelling of pain responses can have a dramatic effect on both adults’ and children’s pain responses (Craig & Patrick, 1985; Goodman & McGrath, 1999). However, empirical knowledge regarding how information transmitted in the context of parent-child interactions during episodes of pain might contribute to the socialization of pain responses in children has been limited primarily to correlational studies focusing on children’s more general distress responses. The current study builds on previous research by enabling conclusions to be drawn regarding the causal role maternal verbal behaviour can play in influencing children’s pain experiences. Further, the results of the current study indicate that
Maternal influences had a differential effect, depending on the gender of the child. This has implications for a social learning perspective on children's pain experiences, indicating that certain socialization processes outlined in the theory may have different effects on boys and girls.

In addition, the current study contributes to our theoretical understanding of how children come to learn about pain in a social context by indicating the possibility that children may first learn information about pain in a modality specific to how it is presented. Mothers in this study presented information about the painful experience in a verbal manner, and their daughters appear to have responded by being influenced in their verbal report of the painful experience. Previous research in which information was presented in a non-verbal manner resulted in children being influenced through their non-verbal display of pain (Goodman & McGrath, 1999). While further research is needed to more systematically address this fascinating phenomena, this observation advances current knowledge regarding how social learning processes may take their effect on the development of children's pain responses.

In summary, the current study provides empirical support for the powerful framework provided by social learning theory for understanding how children's pain responses develop and are influenced within a social context. The findings also extend current theory by indicating that the gender of the child, and the format of how the social information regarding the experience is presented, may play important roles in social learning processes.

Implications for Clinical Practice

These findings have implications for the clinical care of children experiencing acute and chronic pain. The results of this research lend support to the notion that providing special attention for pain, in the form of reassurance, apologies, and empathy, is linked to and perhaps
may trigger the onset and maintenance of perceived elevations in symptoms among children experiencing pain, particularly among girls (Walker & Zeman, 1992). Encouraging parents to take the focus away from children’s pain symptoms, through the use of strategies such as distraction, should continue to be incorporated into psychological treatment packages (Ramsden et al., 1993). Despite the correlational research linking parental use of reassurance and other pain-promoting behaviours to increases in child distress, recommendations directed at parents to help their children cope with acutely painful situations (e.g., venepuncture) continue to include the provision of reassurance. For example, a recent book written to help parents better understand and manage their children’s pain recommends that parents “use words of reassurance and encouragement” (Kuttner, 1996). However, the results of this research indicate that the use of reassurance, in combination with apologies and empathic statements, may actually function to increase girls’ subjective reports of their pain. Although future research is needed, clinical recommendations for parents may need to be altered to reflect these empirical findings, and parents may need to be made aware that reassurance, although a seemingly natural response, is not as effective a strategy as distracting the child, providing concrete suggestions on how to cope, or the use of humour.

The current findings also bear relevance on the common clinical debate regarding whether parents should be present during medical procedures. Research findings have been very mixed with respect to the effects of parental presence, with some studies reporting increased levels of child distress, and other studies finding decreased levels of child distress in the presence of a parent (von Baeyer, 1997). It seems likely that an explanation for the mixed findings can be found in the fact that the mere presence of a parent is not nearly as important as what that parent
does while they are present. For example, the results of this study indicate that a mother of a
daughter undergoing a painful procedure who relies on providing reassurance, apologies, and
empathy is likely to contribute to increasing her child’s subjective report of the pain experience.
On the other hand, a mother who utilizes distraction, suggestions on how to cope, and humour
when confronted with her child’s display of distress is likely to contribute to reports of lower
levels of pain during the procedure. Clinical recommendations regarding parental presence or
absence during medical procedures should be expanded to include recommendations as to how
the parent should behave during the procedure when they are present.

Limitations of the Study

The interesting findings resulting from this research should be tempered with careful
consideration of the limitations of this study. First, although the manipulation of mothers’ verbal
behaviour was generally successful, the majority of what mothers in the pain-promoting group
said was reassuring statements. Further research is needed to systematically examine the direct
effects of other maternal verbalizations, such as the use of criticism and giving control to the
child on children’s pain experiences. In addition, no direct attempt was made to control or
monitor mothers’ non-verbal behaviours in this study. Future studies should attempt to explore
the relative influences of verbal and non-verbal behaviours within the context of parent-child
interactions during pain.

Another limitation of the current study is that it was a lab-based experimental study using
an atypical pain stimulus. The mothers who participated in this study were generally well
educated and of a relatively high socioeconomic status. While, for the purposes of this study,
these limitations actually helped to increase experimental control and improve maternal
adherence to the training scripts, the generalizability of these results to other groups of children, for example children experiencing chronic pain and disability, and their families is not known. Further, this lab-based experimental session represented one brief episode of parent-child interaction around a pain symptom and does not closely approximate the more realistic cumulative effect of repeated parent-child interactions around pain and illness symptoms as children grow older. In addition, due to ethical constraints related to experimentally inducing pain in children, children were aware that they were in control of when they could terminate the painful sensations. This is not typically the case for normally experienced pain and illness symptoms. Future research is needed to examine whether parental influences on children’s pain experiences vary as a function of how much control children perceive they have over their pain.

An additional limitation of the present study was the lack of control over other potential parental influences that may have had an effect on the children’s pain experiences during the cold pressor. For example, it was anecdotally observed that there was tremendous variation in how the participating children’s mothers had prepared them for the experimental session. On one hand, some children had not been told anything about the session in advance and were surprised to learn that they would be asked to engage in the cold pressor task. On the other hand, some mothers were quite diligent about providing their children with all the information that they had learned about the cold pressor over the telephone (e.g., water temperature, duration). Research examining the effects of preparing children for surgical procedures has indicated that children who are prepared in advance of the procedure experience less pain and distress than children who are not previously prepared (Lynch, 1994; Vernon & Thompson, 1993), therefore it seems very likely that parental influences, in the form of preparation, may have taken place prior to even
attending the experimental session. Future research should attempt to control for these preparation effects.

Suggestions for Future Research

The results of this study contribute significantly to our understanding of maternal influences in children’s pain experiences, and future research is needed to continue to shed light on the complex processes involved in the socialization of children’s pain responses. Suggestions for additional research have been provided throughout the discussion of the findings of the current study, but areas particularly deserving of research attention are highlighted below.

Clearly, the results of this research need to be extended to different samples of children and to different pain contexts. For example, it would be interesting to examine whether the same pattern of results would be present among children experiencing recurrent or persistent pains and their families. The use of pain stimuli that are more naturalistic would also be warranted. For example, parents could be trained to interact with their children in a certain way the next time the child complains of an earache or stomachache, and children could be asked to keep a diary describing their pain experience (e.g., intensity, duration) and then these data could be compared to another episode of pain when their mother interacts with them in an alternate manner. It would also be very interesting to replicate this study among a sample of fathers, in order to investigate the influence of paternal behaviour on children’s pain experiences. Paternal behaviour, rather than maternal behaviour, might exert a more powerful influence on boys’ pain experiences.

A critical area for future research is the role of individual child characteristics as moderators of the impact of maternal influence in children’s pain experiences. Anecdotal observations in this study revealed that some children appeared much more amenable to maternal
influence then other children. Attention should be devoted to identifying what child characteristics (e.g., coping skills, pain sensitive temperament) might moderate the effects of maternal behaviour on children’s pain experience, and systematically exploring the role that these characteristics might play in parent-child interactions during episodes of pain.

Additional research is also needed to explore the processes that occur prior to a parent responding to their children’s pain in order to lead to the identification of determinants of parental responses when their children are in pain. Examinations of the role of parental attributions and detailed explorations of the decision-making processes parents engage in when confronted with a child’s pain complaint would be valuable first steps in identifying the processes underlying parental responses to children’s pain.

Conclusions

Parents have long been hypothesized to be influential forces in shaping how their children respond to pain. Unfortunately, empirical knowledge in this area has been hampered by the reliance on correlational designs and poorly defined constructs of child distress and pain. The results of the current study build considerably on previous correlational research and provide evidence that maternal verbal behaviour can play a direct role in influencing their daughters’ subjective reports of pain when the effects of the child’s age are controlled for. In addition, the results of this research suggest that children may learn about pain in a modality specific to how the information is presented to them by their parents. Although future research is needed to extend these findings beyond the laboratory and to different samples of children, this research provides important information regarding how mothers transmit information to their children regarding how they should respond to and experience pain. This information has implications for
a social learning perspective regarding pediatric pain, as well as current clinical practice. In the future, this information could be used as a springboard for further research examining parental roles in pediatric chronic pain as well as the development of empirically-based clinical recommendations to help parents better respond to their children's pain.
References


Measurement of pain in infants and children (pp. 103-122). Seattle, WA: IASP.


Appendix A

Sample Study Advertisement
Are you the mother of a child between the ages of 8 and 12 years?

We are seeking 8-12 year-old healthy children (both boys and girls!) whose mothers would be willing to bring them to the Psychology Department at UBC to take part in a study to find out more about how children learn about hurts and pains.

The study would only take 1 hour of your's and your child's time. Most children and moms have a fun time taking part in the research!! Children will receive a junior scientist certificate and $5 movie theatre gift certificate to thank them for helping us with this valuable research. Moms will receive $5 to cover any parking / transportation expenses.

To learn more about this study, please call Dr. Ken Craig's research lab, 822-5280.
Appendix B

Faces Scales Training Procedure
Child Practice Ratings

1) How much hurt or pain would you have if you got a needle at the doctor’s office?

2) How much hurt or pain would you have if you fell in a big pile of feathers?

3) How much hurt or pain would you have if you had a big operation at the hospital?
4) How yucky or unpleasant would you feel if you were watching a really gory and scary horror movie?

5) How yucky or unpleasant would you feel if you won a free trip to California?

6) How yucky or unpleasant would you feel if you were sprayed by a skunk?
Appendix C

Training Groups Consent Letter
Parent Consent Letter
Children's Pain Experiences Study
Investigators: Kenneth D. Craig, Ph.D., Susan M. Bennett, Ph.D., & Christine Chambers, M.A.

Background: Children, unfortunately, experience a number of pains over the course of growing up. We know very little about how children learn about pains, although it is generally suspected that parents play a big role in influencing how their children react to pain. The purpose of the present study is to train parents to interact with their children in a certain way to see if it has an impact on how children feel during a cold pressor pain task. This information will be invaluable in helping us to figure out what kind of influence parents can have on how children experience pain. This research is being conducted as part of Ms. Chambers' PhD degree at U.B.C.

Study Procedures: As part of this study, we are asking parents to interact with children in three different ways. The way that we will be asking you to behave was determined randomly. To help you learn how to interact with your child in the desired manner, we will be giving you some verbal instructions, let you watch a video of a parent interacting with their child in the same manner you are to, do some role-played practice, and then give you some written reminders that you can keep with you. This training takes about 15 minutes. Also, to help us describe the families of the children taking part, we would ask you to complete some basic demographic information.

While you are being taught how to behave with your child, another research assistant with your child will be explaining to them a little bit more about what they will need to do, and will play a game of your child's choice (e.g., Snakes and Ladders) until you are ready.

After the practice, you will be reunited with your child. To examine children's pain experiences, we will be using a cold-pressor task. The cold-pressor task is a safe laboratory model that has been frequently used to study pain in adults and, more recently, with children. There will be a 2 minute waiting period, and then your child will be asked to put one arm into a cooler of cold (10 degrees Celsius) water for a maximum of 4 minutes (240 seconds). However, your child will be told that they can remove their arm whenever they want to, even before the 4 minute time period is up. Any discomfort experienced goes away very quickly after the arm is removed from the water. During the cold pressor task, we would ask your child to put on a heart rate band and watch and would videotape their facial responses through the one-way mirror. We
would not tell your child that they are being videotaped until the end of the experiment, otherwise knowing they are being videotaped might influence how they react during the cold pressor. We will also be timing how long your child leaves their arm in the water for. After removing their hand from the water, we would ask your child to rate how much pain and how unpleasant they felt while their arm was in the water. At the very end of the study, after asking them some questions about how they felt you were acting when their arm was in the water, we will explain to your child that we had asked you to act in a certain way with them, and also that we had videotaped their faces. The reasons why we couldn't tell them this in advance will be discussed. Participation will take approximately 45 minutes. A general summary of the results of the study will be mailed to you when they are available.

Confidentiality: Any information resulting from this research study will be kept strictly confidential. All documents, including videotapes, will be identified only by code numbers and kept in a locked filing cabinet. Children will not be identified by name in any reports of the completed study. Computer data records will be kept on floppy disks and stored in a locked filing cabinet. No risks are anticipated with taking part in this study.

Compensation: Children will receive a junior scientist certificate and a 5$ movie gift certificate to thank them for taking part. You will receive 5$ to reimburse you for any parking or transportation expenses.

Contact: If you have any questions or desire any further information with respect to this study, you may contact Dr. Kenneth Craig, Professor of Psychology, at 822-3948 or Ms. Christine Chambers, graduate student in psychology, at 822-5280. If you have any concerns about your child's treatment or rights as a research subject, you may contact the Director of Research Services at the University of British Columbia, Dr. Richard Spratley at 822-8598.

☐ I agree to allow my child to take part in the research described above. I understand that my child can refuse to participate or withdraw at any time. I have received a copy of this form for my own records.

☐ I do not agree to allow my child to take part in this research.

Date: ___________________ Name of child: ___________________

Parent signature: ________________ Name of parent: ________________
Appendix D

Control Group Consent Letter
Parent Consent Letter

Children's Pain Experiences Study

Investigators: Kenneth D. Craig, Ph.D., Susan M. Bennett, Ph.D., & Christine Chambers, M.A.

Background: Children, unfortunately, experience a number of pains over the course of growing up. We know very little about how children learn about pains, although it is generally suspected that things like a child's age or gender play a big role in influencing how children react to pain. The purpose of the present study is to learn more about what kinds of things have an impact on how children feel during a cold pressor pain task. This information will be invaluable in helping us to learn more about the kinds of things that have an influence on how children experience pain. This research is being conducted as part of Ms. Chambers' PhD degree at U.B.C.

Study Procedures: As part of this study, we will be providing you with some information about how we study pain in children and will ask you to watch a video about other research projects that are going on in the lab. Also, to help us describe the families of the children taking part, we would ask you to complete some basic demographic information.

While you are being shown the video, another research assistant with your child will be explaining to them a little bit more about what they will need to do, and will play a game of your child's choice (e.g., Snakes and Ladders) until you are ready.

After the video, you will be reunited with your child. To examine children's pain experiences, we will be using a cold-pressor task. The cold-pressor task is a safe laboratory model that has been frequently used to study pain in adults and, more recently, with children. There will be a 2 minute waiting period, and then your child will be asked to put one arm into a cooler of cold (10 degrees Celsius) water for a maximum of 4 minutes (240 seconds). However, your child will be told that they can remove their arm whenever they want to, even before the 4 minute time period is up. Feel free to talk and interact with your child before and during the time that they have their arm in the water just as you normally would. Any discomfort experienced goes away very quickly after the arm is removed from the water. During the cold pressor task, we would ask your child to put on a heart rate band and watch and would videotape their facial responses through the one-way mirror. We would not tell your child that they are being videotaped until the end of the experiment, otherwise knowing they are being
videotaped might influence how they react during the cold pressor. We will also be timing how long your child leaves their arm in the water for. After removing their hand from the water, we would ask your child to rate how much pain and how unpleasant they felt while their arm was in the water, followed by some additional questions about how they felt during the experiment. At the very end of the study, we will explain to your child that we had videotaped their faces and the reasons why we couldn’t tell them this in advance will be discussed. Participation will take approximately 45 minutes. A general summary of the results of the study will be mailed to you when they are available.

**Confidentiality:** Any information resulting from this research study will be kept strictly confidential. All documents, including videotapes, will be identified only by code numbers and kept in a locked filing cabinet. Children will not be identified by name in any reports of the completed study. Computer data records will be kept on floppy disks and stored in a locked filing cabinet. No risks are anticipated with taking part in this study.

**Compensation:** Children will receive a junior scientist certificate and a 5$ movie gift certificate to thank them for taking part. You will receive 5$ to reimburse you for any parking or transportation expenses.

**Contact:** If you have any questions or desire any further information with respect to this study, you may contact Dr. Kenneth Craig, Professor of Psychology, at 822-3948 or Ms. Christine Chambers, graduate student in psychology, at 822-5280. If you have any concerns about your child’s treatment or rights as a research subject, you may contact the Director of Research Services at the University of British Columbia, Dr. Richard Spratley at 822-8598.

☐ I agree to allow my child to take part in the research described above. I understand that my child can refuse to participate or withdraw at any time. I have received a copy of this form for my own records.

☐ I do not agree to allow my child to take part in this research.

Date: ________________  Name of child: ________________

Parent signature: ________________  Name of parent: ________________
Appendix E

Demographic Information Sheet
Child Information

Please complete these questions in reference to your child.

1. Child's Age: ________ (years)

2. Child's Sex (circle one): Male  Female

3. Child's Date of Birth: _____ (month) _____ (day) _____ (year)

4. Child's Weight: ________ pounds or kilograms (circle one)

5. Child's Height: ________ feet or metres (circle one)

6. Child's Ethnicity (circle one number):
   4. Native  5. Indo-Canadian  6. Other:___________

Parent Information

Please complete this information to help us generally describe the families of the children taking part.

1. Your Relationship to the Child (circle one number):
   1. Mother  2. Father  3. Stepmother
   4. Stepfather  5. Other _________________

2. Your Current Age: ________________ (years)

3. Your Current Marital Status (circle one number):
   1. Married  4. Widowed
   2. Divorced/ Separated  5. Never married
   3. Remarried  6. Other _________________

4. Your Education (circle one number):
   1. Graduate School/ Professional training  5. High School graduate
   2. University graduate (4 year college)  6. Some high school
   3. Partial university (at least 1 year)  7. Junior high school graduate
   4. Trade School/Community College  8. Less than 7th grade
5. Your Occupation (please describe): _____________________________________________

6. Your Ethnicity (circle one number):
   1. Caucasian
   2. African-Canadian
   3. Asian
   4. Native
   5. Indo-Canadian
   6. Other: ________________________________________________

7. Your Spouse's/Partner's Current Age: ___________ (years)

8. Your Spouse's/Partner's Education (circle one number):
   1. Graduate School/ Professional training
   2. College graduate (4 year college)
   3. Partial college (at least 1 year)
   4. Trade School/Community College
   5. High School graduate
   6. Some high school
   7. Junior high school graduate
   8. Less than 7th grade

9. Your Spouse/Partner's Occupation (please describe): __________________________

10. Your Spouse/Partner's Ethnicity (circle one number):
    1. Caucasian
    2. African-Canadian
    3. Asian
    4. Native
    5. Indo-Canadian
    6. Other: ________________________________________________

11. Number of Family Members: _______ Adults _______ Children
    For each child in your family please list their age, sex, and whether or not they currently reside in your home.
    Age: ____ Sex (circle one): Male Female Living at home? (circle one): No Yes
    Age: ____ Sex (circle one): Male Female Living at home? (circle one): No Yes
    Age: ____ Sex (circle one): Male Female Living at home? (circle one): No Yes
    Age: ____ Sex (circle one): Male Female Living at home? (circle one): No Yes
    Age: ____ Sex (circle one): Male Female Living at home? (circle one): No Yes

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Appendix F

Self-Report Pain Intensity and Affect Measures
Child Cold Pressor Ratings

Pain Tolerance: ________ (in seconds)

3) How unpleasant or yucky did you feel when your hand was in the water?

1) How much hurt or pain, on average (taken all together), did you have when your hand was in the water?

2) What was the worst hurt or pain that you had when your hand was in the water?
Appendix G

Junior Scientist Certificate
Appendix H

Pain-Promoting Verbalization Reminder Sheet
Training Information Reminders

**General Description:** We would like you to try your best to say things to your child that:

1. are **reassuring** to your child.
2. show **understanding or empathy** for how your child is feeling.
3. **apologize** for any discomfort experienced by your child.
4. give **control** to your child or put him/her "in charge".
5. mildly **object** to your child's behaviour.

**Examples:** From the following list, please circle around 10 statements that you would feel comfortable saying to your child.

| "You're doing fine." | "You can do it." | "I'm sorry it's so cold". |
| "I know it hurts." | "Don't worry, only a bit longer." | "It won't be too bad." |
| "It will be over soon." | "I know your hand must be freezing." | "It's almost over." |
| "I'm sorry this is taking so long." | "I'm sure this would be tough for anyone." | "Come on, you're a big girl/boy, you can take it." |
| "That must be cold." | "Not much longer now." | "You know you're in control here." |
| "You must be getting tired." | "You're trying really hard." | "Oh come on, it's not that bad." |
| "I know this is hard." | "You're not in a very good mood today." | "That's good." |
| "You can take your hand out whenever you want." | "You'll be okay." | "Not much longer now." |

**Guidelines:**

1. Please try to say at least 3 of the above during the 2 min. waiting period and at least 6 of the above during the up to 4 min. that your child has his/her arm in the water.
2. Please **do not** say anything that will:
   - distract your child from what she/he is doing
   - give your child specific ideas on how to cope when his/her arm is in the water
   - make your child laugh or joke around with your child
3. If your child asks if she/he can remove his/her arm from the water, please say "I know it must be cold, remember you can take your arm out whenever you want."
Appendix I

Pain-Reducing Verbalization Reminder Sheet
Training Information Reminders

General Description: We would like you to try your best to say things to your child that:

1. distract your child from what she/he is doing.
2. provide your child with suggestions on how to cope with the cold.
3. joke around with your child.

Examples: From the following list, please circle around 10 statements that you would feel comfortable saying to your child.

<table>
<thead>
<tr>
<th>&quot;Relax.&quot;</th>
<th>&quot;Look at a spot on the wall.&quot;</th>
<th>&quot;It's better if you try not to think about it.&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;What movie would you like to see with your certificate?&quot;</td>
<td>&quot;Take a deep breath.&quot;</td>
<td>&quot;Try wiggling your fingers around.&quot;</td>
</tr>
<tr>
<td>&quot;Try counting backwards from 10&quot;</td>
<td>&quot;Concentrate on something else.&quot;</td>
<td>&quot;Try to relax the muscles in your arm.&quot;</td>
</tr>
<tr>
<td>&quot;Close your eyes and imagine...&quot;</td>
<td>&quot;We're having _______ for dinner tonight.&quot;</td>
<td>&quot;Pinch your nose.&quot;</td>
</tr>
<tr>
<td>&quot;Look at me.&quot;</td>
<td>&quot;Good thing they're not asking you to go swimming in there.&quot;</td>
<td>&quot;Oh, you're being silly!&quot;</td>
</tr>
<tr>
<td>&quot;Breathe.&quot;</td>
<td>&quot;Don't forget to move your fingers around.&quot;</td>
<td>&quot;This is a pretty small room.&quot;</td>
</tr>
<tr>
<td>&quot;That’s a nice poster on the wall.&quot;</td>
<td>&quot;Think about your favorite TV show/movie.&quot;</td>
<td>&quot;Any fish swimming around in there?&quot;</td>
</tr>
<tr>
<td>&quot;I hope we don’t get caught in traffic on the way home.&quot;</td>
<td>&quot;Think about what you’re going to do tomorrow/this weekend.&quot;</td>
<td>&quot;It helps if you take a deep breath.&quot;</td>
</tr>
</tbody>
</table>

Guidelines:
1. Please try to say at least 3 of the above during the 2 min. waiting period and at least 6 of the above during the up to 4 min. that your child has his/her arm in the water.
2. Please do not say anything that will:
   - be reassuring to your child.
   - show understanding or empathy for how your child is feeling.
   - apologize for any discomfort experienced by your child.
   - give control to your child or put him/her “in charge”.
   - mildly object to your child’s behaviour.
3. If your child asks if she/he can remove his/her arm from the water, please say "Try wiggling your fingers around, remember you can take your arm out whenever you want."
Appendix J

Control Group Reminder Sheet
Parent Reminders

- When the watch beeps, please remind your child to lower their hand into the water so that their wrist is in the water.

- Feel free to interact and talk with your child just as you normally would when they are hurt or in pain.

- The watch will beep again when the 4 minute interval is up and it is time for your child to remove their hand from the water.

- However, your child is allowed to remove their hand from the water at any time if they desire.

- If your child asks you if they can remove their arm from the water, please say something like "Remember, you can take your arm out whenever you want."