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Contribution of parental behaviour to pain-related disability, pain behaviour
and symptom reporting in children

by

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Abstract

This research examined the relations among variables related to a parents' pain experience, such as the frequency and severity of pain complaints and the impact of pain episodes on daily functioning, on similar variables in their children. Two studies were carried out. Study 1 was a prospective, epidemiological survey of pain complaints among 693 families with children (8-18 years old). Participants recorded all incidents of pain that occurred during a 7-day period in a diary. Results showed that children whose parents reported relatively more pain incidents, or more clinically severe incidents, were at increased risk of also reporting relatively more pain incidents and more clinically severe incidents. Similar findings were noted for disabling incidents. This study demonstrated that pain incidents tend to co-occur within families and provided support for the commonly held notion that pain "runs in families". The purpose of Study 2 was to determine whether observing a parent's reaction during a cold pressor test would have an impact on a child's pain threshold, pain-related facial activity, and ratings of pain intensity. Mother-child pairs (n=96; 48 boys; M child age=12.6 years, SD=1.2 years) were randomly assigned to 1 of 3 groups. With the child unaware, mothers were instructed to either minimize or exaggerate their display of pain during a cold-pressor task (10°C water, maximum duration of 4 minutes). Results showed that children whose mothers minimized their display of pain showed significantly less pain-related facial activity and lower ratings of pain threshold than those whose mothers exaggerated their display of pain, or control mothers. No between group differences were found on children's ratings of pain intensity. Findings from both of these studies suggest that social learning factors, such as modeling, have an impact on a child's pain behaviour.

Abbreviations and Symbols

Measures

CFCS	Child Facial Coding System
CSQ	Coping Styles Questionnaire
FACS	Facial Action Coding System
FDI	Functional Disability Inventory
IBES	Illness Behavior Encouragement Scale
PCS	Pain Catastrophizing Scale
STAIC	State-Trait Anxiety Inventory for Children
STAI	State-Trait Anxiety Inventory
VAS	Visual Analogue Scale

Medical and Health Terms

IBS	Irritable Bowel Syndrome
PUD	Peptic Ulcer Disease
RAP	Recurrent Abdominal Pain
TMPDS	Temporomadibular Pain and Dysfunction Syndrome

Statistical and Scientific Notation

α coefficient alpha, or probability level

ANOVA   Analysis of Variance

ANCOVA   Analysis of Covariance

°C   Degrees Celcius

95% *CI*   95% Confidence Interval

df   Degrees of Freedom

F F-test Statistic

ICC   Intraclass Correlation

χ^2 Chi Square statistic

M   Mean

n   Number of subjects/respondents

ns   not statistically significant

OR   Odds Ratio

p   probability level

r   Correlation Coefficient

RR   Relative Risk

SD   Standard Deviation

t   T-test statistic

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CHAPTER 1. INTRODUCTION

Overview

Pain is a part of everyone's experience. By definition, it is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." (International Association for the Study of Pain, 1994, p. 210). Pain is always subjective and can not be directly observed or measured, only inferred through self-reports, behavioural observations, or physiological indices. Although there is clearly a physiological substrate to pain, pain perception and expression involve a number of complex subjective responses which have been shown to be influenced by both biologically-based factors as well as by cultural and experiential factors.

As the first and longest-lasting setting for development, the family provides an ideal situation for learning about pain. From birth onward, children are presented with an immeasurable number of opportunities to learn about pain. In addition to promoting survival and development of its members, a primary function of the family is the socialization of its members. Young are trained by mature members to become competent, participating members of society. This process occurs within the context of emotional support which binds individuals together and creates an environment which fosters learning. These processes of socialization also apply to learning about pain. Children can compare their own experiences to those of parents, siblings, and other relatives, creating a rich and diverse learning opportunity. Further, direct experience with and observation of stressful life events related to pain, positive and negative consequences for reporting pain, or displays of pain-related disability, instructions about what to do after reporting pain,

and modeling of pain-related phenomena provide additional information for a child about what to do and how to behave when in pain. The family is a universally important social system for the child, and in most circumstances, continues to have an impact on functioning throughout adolescence and adulthood.

There is considerable anecdotal and some empirical evidence that children learn about pain within the context of their family. Many researchers have acknowledged that childhood provides the appropriate social context whereby positive and negative consequences of assuming different roles related to health are learned (e.g., Burbach & Peterson, 1986; Craig, 1983). Parental values concerning health and illness have particular importance for shaping children's health-related behaviour as they provide general guidelines for how a child should behave across a broad range of health-related situations (Campbell, 1978). These values likely influence a child's appraisal of situations involving pain, in part, through a series of subtle processes involving vicarious reinforcement by observing others' behaviour when experiencing or reporting pain and the consequences of these behaviours.

The basic tenets of social learning theory (Bandura, 1977) and social cognitive theory (Bandura, 1986) have proposed that humans have the capacity to learn by observation. This capability allows people to acquire rules for generating and regulating behavioural patterns without direct experience and without having to rely on tedious trial and error. The learning process is thereby expedited by providing the individual a way of acquiring new skills and information that is not limited by the constraints of direct exploration and experience. In the broadest sense, a person has the capacity to learn

through processing information about behaviour and its consequences portrayed through any media, whether actual or symbolic.

These theories suggest that there are several conditions which must be met for modeling and vicarious reinforcement of a behaviour to occur (Bandura, 1977; 1986). First, the individual who models the behaviour of interest must be salient to the target. Second, the person who models the behaviour must receive positive consequences as a result of displaying the modeled behaviour. When these principles are applied to situations involving pain in children, a parent or a parental figure is usually identified as the individual who models the behaviour by either displaying pain behaviours or by reporting pain. Positive consequences as a result of reporting pain may include receiving attention from other family members or relief from expected household or work place responsibilities. For example, when a parent reports pain from a migraine and subsequently receives increased attention from her or his spouse and misses work, the child has the opportunity to observe positive consequences resulting from the report of pain by the parent.

Because modeling is a process, rather than an overt and discrete event, it has been and continues to be difficult to empirically demonstrate that it is implicated in the development of pain problems in children. Furthermore, it is unlikely that the social learning processes which underlie modeling are solely responsible for causing behaviour in the natural environment. It is widely acknowledged that both experiential and physiological influences interact in subtle ways to determine behaviour (Bandura, 1977). It is more likely that social learning processes are some of the many factors which contribute

to the development of complex behaviour patterns, such as reporting pain or displaying pain behaviour.

Modeling, as a process underlying the acquisition or display of a behaviour, is often implicated by examining its outcomes. There are two methodologies which are commonly used to empirically examine whether modeling is a possible and theoretically plausible explanation for behaviour. One is the correlational approach which seeks to determine the nature of the relation among a set of variables (e.g., using a prospective or retrospective survey or case series design). For example, consider the situation where a parent and a child both experience recurrent headaches and where each typically avoids social activities during headache episodes, but not work- or school-related commitments. By identifying the co-occurrence of these events, we obtain evidence to support that modeling may play a role in both the report of the child's headache, and the impact of a the headache on his or her social or academic functioning. Research that systematically examines the co-occurrence of pain-related phenomena is one important way of providing evidence that modeling is an important mode of transmission of pain problems.

An obvious disadvantage to correlational research designs is that it is easy to argue that other factors or causal agents may underlie the outcome of co-occurring pain problems such as those described above. For example, the child and the parent may have a similar genetic predisposition to having recurrent headaches. Having a disorder such as migraine headache is probably biologically-based. However, the frequency and severity of episodes may be influenced by learned behaviour. For example, reporting headache, reporting descriptive pain characteristics (e.g., where it hurts, what it feels like) associated

with headache, and the impact of the headache on daily functioning are more likely

influenced by social learning processes. Research that empirically demonstrates co-

occurrence of pain problems can not alone, provide irrefutable evidence that modeling is

responsible for the transmission of pain problems from parent to child. Studies that

demonstrate co-occurrence do not tell us what is learned during transmission, or how

transmission occurs.

Laboratory based experiments are another way of providing more direct evidence

that social learning factors have an impact on what people do when they have pain (e.g.,

Prkachin & Craig, 1985; Baker & Kirsch, 1991). Laboratory based studies of pain have

several unique advantages over studies of pain in the natural environment. Experimental

pain methods provide a means of standardizing the pain stimulus, both in the type of pain

(e.g., cold pressor, electrical stimulation), and in the intensity of the stimulus delivered

Edens & Gil, 1995). Similarly, the self-report of pain, as well as nonverbal indices of pain

such as facial expression and psychophysiological measures (e.g., EEG recordings, vagal

tone), can be more easily quantified in a standardized and controlled laboratory setting,

which allows the relation between the amount of stimulation and perceived hurt to be

examined as it unfolds (Gracely, 1994). However, because variables are typically

manipulated in an artificial setting and the type of pain may have unique sensory, affective,

and behavioural components, findings of experimental research are often not directly

applicable to behaviour that occurs in the natural environment. Experimental pain is

typically more predictable than pain events that occur in day-to-day life, and this type of

pain does not carry the same emotional and medical significance, or impact on daily

functioning associated with acute, recurrent, or chronic pain (Edens & Gil, 1995).

Combining both types of methodologies is preferable, as it enables the same phenomena to be empirically examined from very different angles. For example, prospective survey research captures the occurrence of important variables as they occur in their natural environment, and the number of possible variables to be explored is virtually endless. Experimental research, on the other hand, is more limited in its applicability, but potentially offers a less biased view of the variables under examination.

Many of the studies which have suggested that modeling of pain underlies the presence of pain problems in children have attempted either to identify the presence of a suitable pain model in the child's environment, or to examine the co-occurrence of pain problems within families (e.g., Turkat, Kuczmierczyk, & Adams, 1984; Ehde, Holm, & Metzger, 1991; Zuckerman, Stevenson, & Bailey, 1987). However, there are several methodological limitations that are common among many of these studies. For example, much of this research has relied on samples obtained from tertiary care clinics. It very unlikely that all children with chronic or recurrent pain problems receive care from specialty clinics, which limits the generalizability of these results. As such, results and conclusions from these studies may not be readily applied to all children with pain problems.

Some evidence exists which suggests that people who seek health care from tertiary care outpatient clinics differ from the general population on several important variables. For example, a group of researchers at the University of Alabama at Birmingham (in the United States; Aaron et al., 1996; Aaron et al., 1997; Alexander et al.,

1998) have published a series of studies which has attempted to delineate which variables are predictive of seeking medical treatment among adults with a chronic painful condition. The chronic painful condition under examination was fibromyalgia, a non-articular rheumatic pain condition characterized by widespread pain, decreased pain threshold at tenderpoint sites, sleep disturbance, and fatigue. For example, Aaron et al. (1996) examined the frequency of lifetime psychiatric diagnoses among women with fibromyalgia recruited from a tertiary care clinic, women with fibromyalgia recruited from the community (via newspaper advertisements) who had not sought medical treatment for their symptoms, and healthy, pain-free controls. Results showed that women formally diagnosed and treated for fibromyalgia had a greater number of lifetime psychiatric diagnoses than nonpatients and healthy controls (approximate mean of three diagnoses for patients compared to one diagnosis for nonpatients and controls), and that psychiatric symptoms typically predated the onset of pain among both the pain groups. Fibromyalgia patients also reported greater pain, lower pain threshold, and greater functional disability than fibromyalgia nonpatients, which accounted for increased psychological distress among the patients with fibromyalgia. The authors concluded that premorbid psychiatric symptoms are more strongly related to seeking health care for fibromyalgia than to the development of the fibromyalgia itself.

In a similar study, Aaron et al. (1997) evaluated whether perceived physical and emotional trauma could be identified as a precipitating factor for both the onset of fibromyalgia among women and men, as well as its relation to whether or not health care is sought for fibromyalgia symptoms. Again, a sample of women and men diagnosed with

fibromyalgia who were seeking medical treatment for this condition and a community-based sample, recruited from newspaper advertisements, who met diagnostic criteria for fibromyalgia but who had not sought treatment for their symptoms participated (both the patient and nonpatient samples were largely composed of women). Results showed that patients seeking treatment for fibromyalgia were significantly more likely to report either an emotional or physical trauma which preceded the onset of their pain symptoms, as compared to those not receiving medical care for their symptoms. Further logistic regression analyses showed that the presence of an emotional trauma which precipitated the onset of fibromyalgia was the largest predictor of patient (i.e., health care-seeker) versus nonpatient (i.e., non-health care-seeker) status. It is also interesting to note that trauma history was not related to either pain severity or threshold. The authors noted that these findings are consistent with health care-seeking in the general population in that stressful life events and emotional distress are generally predictive of health care utilization (e.g., Kessler et al., 1987).

Alexander et al. (1998) examined whether a history of physical or sexual abuse was related to health care utilization patterns among women with fibromyalgia. Results showed that women receiving care for fibromyalgia who had a history of physical or sexual abuse reported more outpatient clinic visits for difficulties unrelated to fibromyalgia than fibromyalgia patients without a history of abuse. Further, patients with a history of abuse also reported greater pain, functional disability, fatigue, and greater usage of medication for pain than nonabused fibromyalgia patients. Further, a second group of women in this study who met diagnostic criteria for fibromyalgia but who were not

seeking medical treatment were as likely as healthy, pain-free controls to report a history of physical or sexual abuse. Taken together, these findings suggest that a history of abuse is more strongly related to seeking health care for fibromyalgia than to the presence of fibromyalgia itself.

The results of these studies suggest that variables such as emotional distress and emotional trauma, physical or sexual abuse, and psychiatric symptoms frequent or severe enough to warrant diagnosis are some of the variables, in addition to pain and somatic symptoms, that may explain seeking medical care from a tertiary care clinic for a chronic painful condition among adults. These are likely not the only variables which contribute to a complex behaviour such as seeking medical treatment and the relative importance of each of these (and others) is likely different for different types of pain conditions. Further, it is unlikely that these findings are directly applicable to explain the health care-seeking behaviour of parents for their children with a chronic or recurrent pain problem, or to explain the health care-seeking behaviour of children via their parents. However, these data provide a useful starting point for better understanding research conducted with samples obtained from tertiary care clinics.

It may also be that parents who have pain problems themselves are more likely to seek medical treatment for their child's pain than parents who do not have a recurrent pain problem. This possibility would artificially inflate the rate of co-occurrence of recurrent pain among parents and children in research with participants drawn from tertiary care clinics. Moreover, it is not yet known whether pain complaints co-occur within families in the general population (Goodman & McGrath, 1991). That is, the relation between

parents' and children's pain complaints among children without disabling pain problems has not been thoroughly investigated. There is some evidence that, among healthy adults (i.e., without chronic or recurrent pain problems), a positive relation exists between the frequency and severity of pain complaints and the number of familial pain models reported during childhood. For example, Turkat and Noskin (1983) surveyed 27 healthy adults (19 women, mean age=29 years) regarding whether illness typically interfered with their parents' work, chores, or other activities. Respondents whose parents avoided work or other activities due to illness (n=10) were significantly more likely to report current and childhood work/activity avoidance while ill than those whose parents did not avoid activities while ill (n=17). Respondents whose parents avoided work also reported receiving more positive attention when ill compared to other respondents. The authors suggested that modeling of illness-related avoidance and receiving positive consequences for avoidance were the psychological mechanisms responsible for the development and maintenance of these behaviours.

In a similar study, Edwards, Zeichner, Kuczmierczyk and Boczkowski (1985) examined the number, duration, and intensity of 10 common pain symptoms in a sample of 120 male and 168 female undergraduate university students (mean age=19.1 years). Target symptoms included pain in the following areas: back, neck, joints, muscles, chest, abdominal area, teeth/ears, as well as internal pain, menstrual pain (in women) and headache. Participants also reported whether family members had persistent pain in any of these areas. No significant difference was found between the number of pain models reported by males (mean=6.1 models) and females (mean=6.1 models). A significant

relation was found between the number of pain symptoms reported by the students for themselves and for their family members (r=0.32, p< 0.0001). Multiple regression analyses showed that there was a higher degree of concordance between parents and children for pain symptoms reported by females than for symptoms reported by males. This study provides evidence that pain complaints may co-occur among family members in the general population.

Edwards, O'Neill, Zeichner and Kuczmierczyk (1985) surveyed 224 university undergraduate students (150 females, mean age=19.0 years) regarding the number of family members with persistent pain and the frequency with which their parents missed work due to pain. Respondents were classified as having either a high or low number of pain models using a median split. For example, those who identified six or more pain models were classified as "high" (mean=9.9 pain models) and those who identified fewer than six models were classified as "low" (mean=2.8 models). The "high" pain model group reported significantly more frequent pain than the "low" pain model group. Further, the "high" pain model group reported that both their mothers and fathers missed work significantly more frequently, and perceived their parents to be less able to work, than either of the parents of the "low" pain model group. These results suggest a significant positive relation between perceived secondary gain for pain (i.e., missed work) in a model and current pain experience.

Although it was very likely that the samples from these two studies were more highly educated than what is typical (i.e., university students), a strength of them was that participants were not selected based on a health-related variable. However, the study used

a retrospective survey which likely compromised the reliability of the data. A prospective

design would have minimized recall bias and error. This study also asked the participants

to report on the pain experiences of their family members instead of directly questioning

the family members themselves. As such, the possibility of another reporting bias exists.

However, the participants' perception of their family members' pain experience is likely as

influential as a risk factor for increased pain as is the actual self-reported experience of the

family member.

Some research has noted the importance of family pain models in adult patients'

reports of pain following surgery. For example, Bachiocco, Scesi, Morselli, and Carli

(1993) examined the role played by previous pain experience and familial pain tolerance

models on reports of pain following thoracic surgery among 126 patients, free from

chronic pain (36 females, mean age=55 years, age range=17-78 years). Patients were told

to request analgesics only if they were unable to tolerate post-surgical pain, and were

encouraged to use non-pharmacological means of coping with the pain. Patients who had

reported "good" tolerance models in their past and present families, defined as individuals

who were not disabled by pain and complained less frequently, reported less pain than

individuals recalling poor tolerance models, defined as individuals who were disabled by

pain and who complained more frequently. Patients who had a past history of medical pain

had higher reports of pain than patients without a history of medical pain. Although the

study used a somewhat unusual post-surgery analgesia protocol, the results provide

evidence that perceptions of early learning are related to pain experiences that occur much

later in life.

Family pain models and practices and their relation to menstrual symptoms and illness behaviour have been the subject of considerable research. Whitehead, Busch, Heller and Costa (1986) asked female nursing students aged 18 to 39 years (n=351) to complete a questionnaire that assessed the frequency of parental behaviours occurring during adolescence that encouraged adoption of the sick role during menses (e.g., being excused from chores) and during "colds" (e.g., receiving special toys or gifts). Respondents were also asked an open-ended question about their mothers' modeling of menses-related illness behaviour (e.g., whether their mother stayed home from work because of painful menstruation), and completed several questionnaires about frequency of physical and menses-related symptoms. Mothers of respondents completed a similar questionnaire. Significant positive relations were found between the number of physical symptoms and severity of menstrual symptoms reported by students and encouragement and modeling of the sick role during adolescence. Mothers' self-reports of encouragement and modeling of the sick role were also related to the number and severity of reports by their daughters. These findings provide additional support that early learning opportunities among health children regarding pain and illness are related to health-related behaviours that occur later in life.

Despite the indirect manner by which modeling and vicarious reinforcement have been implicated in the development of pain problems in children, and the methodological difficulties of examining these variables, it remains highly plausible that these processes could partially explain both the co-occurrence and transmission of pain complaints within families (Craig, 1978; Craig, 1983). Within the family, the child has the opportunity to

observe the consequences of pain complaints and the impact of pain-related disability in

salient figures, namely parents. In situations where positive consequences and secondary

gain for pain-related phenomena are observed, such as missing work or receiving

increased attention from a marital partner, a child may be more likely to engage in similar

behaviour (Edwards, O'Neill, Zeichner & Kuczmierczyk, 1985; Rickard, 1988;

Whitehead, Winget, Fedoravicius, Wooley, & Blackwell, 1982). It is therefore inferred

that in situations where parents frequently obtain secondary gain from their complaints of

pain, children will learn to exhibit similar patterns of pain complaints, functional disability,

and handicap through vicarious reinforcement.

The present research seeks to evaluate the importance of parental modeling of

pain-related phenomena on children's behaviour. Two studies were carried out. In a

prospective epidemiologic survey, the first study examined the degree of concordance in

the number, severity, and functional impact of pain complaints among families with

children. It was expected that mothers and fathers who reported high levels of pain would

be more likely to have children who also reported high levels of pain. Results of this study

would provide evidence that co-occurrence of pain complaints, one of the outcomes of

modeling, occurs within the general population. By examining this outcome, we could

then infer that modeling may be one of the psychological mechanisms that accounts for

this co-occurrence. The second study examined whether factors related to modeling, such

as direct observation of behaviour in the context of positive and negative consequences,

could be experimentally manipulated to show that parental modeling has a significant

impact on a child's behaviour during an experimental pain induction paradigm.

Co-occurrence of Pain Complaints

Research investigating the co-occurrence of pain complaints has examined the

degree of concordance in the frequency, severity, and type of pain among children and

parents or other salient figures using a variety of research methodologies. For example,

some studies have investigated the presence of target symptoms such as frequency of pain

complaints or other physical symptoms in children whose parents or other family members

have a chronic or recurrent pain condition. Another related line of research has examined

whether the parents or other adult family members of children identified with a recurrent

pain condition (e.g., recurrent abdominal pain) have more frequent physical complaints

such as headache, or abdominal pain compared to parents of healthy children. These areas

of research, although addressing different questions, all attempt to determine whether the

presence of, or exposure to, an individual with a recurrent pain problem places a child (or

adult) at increased risk for reporting pain, or other related symptoms.

Pain in Children Whose Parents Have Chronic Pain

Rickard (1988) examined the impact of having a father with chronic low back pain

on child functioning on a number of psychological variables. A sample of 21 8- to 12-year-

old children (mean age=9.6 years; 9 males) whose fathers had chronic low back pain were

compared to 21 9- to 12-year-old children (mean age=10.4 years; gender composition not

specified) who had a parent with insulin-dependent diabetes mellitus and to another 21

children (mean age=9.8 years; 12 males) with healthy parents on measures of teacher-rated

behaviour problems, physical complaints and school absence, as well as on the children's

responses to health-related scenarios. Fathers with chronic low back pain were recruited

from a rehabilitation centre. Children came from similar socioeconomic backgrounds.

Teachers of participating children completed the Conners Teacher Rating Scale (Conners,

1969) and a classroom behaviour monitoring form to keep track of physical complaints,

avoidance behaviours, crying, and dependency behaviours over a 15-day period.

Absences from school and visits to the school nurse within the past year were also

recorded. Children completed the Child Health Locus of Control questionnaire (Parcel &

Meyer, 1978) and responded to six hypothetical scenarios designed to evoke pain-related

behaviour with a forced-choice answer. For example, one such scenario asked the student

to respond to a situation where a class bully starts to poke him or her with a pencil.

Response choices for this scenario included: (1) telling the bully to stop; (2) telling the

teacher; (3) telling the bully that you do not "feel well"; and (4) moving away from the

bully. Parents of the children completed the Illness Behavior Questionnaire (Pillowsky &

Spence, 1975), a 62-item yes/no checklist of illness symptoms and other problems related

to illness.

Results showed that the children of chronic pain patients were reported to

frequently complain, cry, exhibit avoidance and dependency behaviours, and be absent

from school or seek the help of the school nurse by their teacher at a significantly higher

rate than children in the other groups. Pain-related responses were reported significantly

more often by children of parents with chronic pain than by the children of diabetics or

healthy controls. The author concluded that it was likely that these behaviours were

learned through observation of and interaction with parents who displayed chronic pain

behaviour. The results of this study offer support that modeling of parental pain behaviour could be one of the mechanisms by which development of these behaviours occurred. Despite the correlational nature of the data, these results suggested that children may be at increased risk of developing problems related to abnormal illness behaviour when exposed to salient figures with significant and disabling pain problems.

Multiple aspects of functioning in children who had mothers with a chronic pain condition or chronic illness (insulin-dependent adult onset diabetes) compared to children whose mothers were pain or illness-free were also examined in a study by Dura and Beck (1988). Twenty-one families (7 per group), each comprised of a mother, a father, and a child between the ages of 7 and 13 years completed study measures. Differences in the child's self-reported depression, parent-rated social skill level and behaviour problems, parent ratings of general health and the reported number of days with complaints of illness during the two weeks prior to the study interview, as well as the number of days absent from school determined from school attendance records were examined between groups. Children whose mothers had chronic pain had significantly higher levels of self-reported depression. The authors also noted a consistent trend (not statistically significant) that children in the chronic pain group had lower levels of parent-rated social skills, higher behaviour problems scores, lower mother-rated health, more frequent days absent from school, and more frequent days with complaints of illness. It is likely that the small sample size (n=21; 7 per group) did not provide enough power for these differences to reach statistical significance between groups. The authors concluded that the mothers' chronic pain had a direct, negative impact on the overall emotional adjustment and physical

functioning in their children, however they did not speculate about the mechanisms underlying these compelling associations.

Mikail and von Baeyer (1990) also compared children whose parents had a chronic pain condition to children with pain-free parents on a number of psychological and health-related variables. Chronic headache sufferers (n=24) were recruited from a pain clinic of a university hospital and healthy adults (n=30) were recruited from a general optometry practice. Participating children were between 9 and 17 years old. Children of headache sufferers reported significantly more headaches during a one-month period and had a more negative somatic focus than children of headache-free parents. On the Personality Inventory for Children (Wirt, Lachar, Klinedinst & Seat, 1984), a measure of a child's personality completed by parents, children of parents with headache had significantly higher Delinquency scores, and significantly lower Social Skills and General Adjustment scores. The authors concluded that children whose parents had chronic headaches were more preoccupied with their health status and bodily functions than children in the other group. This difference was, in part, attributed to the manner in which these children may have responded to their parents condition.

Raphael, Dohrenwend, and Marbach (1990) examined the frequency of parent-reported illness and injury among children of mothers who had temporomandibular pain and dysfunction syndrome (TMPDS) compared to children with healthy parents. Parents with TMPDS (n=31) were much more likely to report illnesses among their children than were healthy control parents (n=41). No differences were noted when rates of illness and injury among spouses as reported by TMPDS patients and healthy controls were

examined, suggesting that the increased illness rate observed for children of TMPDS patients was not due to biased responding. Although the nature of the illnesses was not specified, parents with TMPDS were noted to have reported more frequent illnesses and injuries among themselves in a previous study (Marbach, Lennon & Dohrenwend, 1988). These findings appear to be consistent with the position that children whose family functioning is compromised by chronic pain, are more likely to experience pain and illness. Whether this vulnerability is transmitted genetically, through early socialization experiences, or through interaction of these variables remains to be determined.

Primary caregivers (n=42) of children, aged 6 to 18 years (26 males), with a parent who was currently receiving treatment at a university-based pain clinic were interviewed regarding their child's pain and illness behaviour in a study by Jamison and Walker (1992). The target child in the family was the youngest, unless the youngest had a chronic illness or disability. Approximately half of participating parents were receiving treatment for chronic pain, and the remainder of the sample had a spouse who was receiving treatment. A large majority (n=39) of respondents were mothers. Children with more frequent pain complaints had parents whose chronic pain was associated with significantly greater functional disability, more pain behaviour, and higher levels of emotional distress than did children with less frequent pain. When compared to a group of 55 mothers without chronic pain and their children, children of parent's with chronic pain had significantly more frequent complaints of abdominal pain, and medication usage for gastrointestinal and other symptoms. These results appear to suggest that children of parents with chronic pain are at greater risk of having more pain complaints, and displaying more illness behaviour

(e.g., medication usage) than children of healthy parents. However, the investigators did not obtain corroborating, self-report measures of somatic symptoms, pain frequency, or medication usage from the participating children. It is possible that a parent with a chronic pain condition is more aware of pain complaints in their child, and that more severe pain is related to greater vigilance regarding pain symptoms among other family members. The primary caregiver/respondent who provided information about the child's pain and illness behaviour was not necessarily the parent with chronic pain. Determining whether the children identified with frequent pain were more likely to have respondents who had chronic pain may have helped to answer this question.

In these studies, maladaptive behaviours identified in children whose parents had a recurrent or chronic pain problem were hypothesized to be learned through observation of, and interaction with, parents who displayed chronic pain behaviour. However, none of these studies empirically evaluated whether parents in the recurrent/chronic pain groups received positive consequences as a result of their painful condition. For example, whether parents missed worked or received more positive attention resulting from their complaints of pain was not assessed, nor was whether the child perceived any positive consequence for the parent as a result pain. Although modeling remains a theoretically viable psychological process which may explain significant rates of concordance between parents with recurrent pain and their children, these studies failed to show that all theoretically necessary components of modeling were present in the family environment. However, all of these studies suggest that the presence of a parent with a chronic pain condition places a child at increased risk for reporting pain and other pain-related behaviour.

Pain in Family Members of Individuals with Chronic Pain

Several studies have shown that individuals with recurrent or chronic pain conditions often come from families with a positive family history of recurrent or chronic pain. Empirical evidence for this association is available from studies examining both adults and children with pain problems.

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Adults with Chronic or Recurrent Pain

Whitehead, Winget, Fedoravicius, Wooley, and Blackwell (1982) compared the nature and severity of illness behaviour reported by a sample of 67 adults with irritable bowel syndrome (IBS; 39 females) and 84 adults with peptic ulcer disease (PUD; 32 females) identified through an epidemiological telephone survey (n=832 adult respondents). IBS was defined as frequent bouts of abdominal pain (other than menstrual pain) or gas distention associated with diarrhea or constipation, whereas PUD was defined as adults who had been told by a physician that they had an ulcer. Adults with IBS were significantly more likely than other survey respondents, including adults with PUD, to report having two or more colds in the previous year, and that their colds were more severe than those of most other people. Those with IBS were significantly more likely to report that they had two or more acute illnesses in the previous year, and to report being hospitalized for acute illnesses compared to other survey respondents and adults with PUD. They also reported having other chronic disorders such as tension headache, skin rashes, back pain, or other muscle pain at a significantly higher rate than the other survey respondents. Further, respondents with IBS were significantly more likely than those with

PUD to report that their parents gave them special toys or treats when ill as a child, although they were not more likely to miss school because of illness. These results suggest that adults with IBS, a type of abdominal pain without a clearly defined organic basis, reported more frequent illness behaviour and more secondary gain from illness as a child than adults with abdominal pain resulting from a medical problem. Although these data are retrospective, they are consistent with a social learning explanation of illness behaviour among individuals with medically unexplained pain.

Turkat, Kuczmierczyk, and Adams (1984) examined the frequency and severity of headache symptoms in a group of 30 chronic headache sufferers (20 females; mean age = 27.8 years) recruited from local physicians and newspaper advertisements. Immediate family members were aslo asked about similar symptoms. These data were compared to those from a control group of 22 healthy volunteers without history of chronic headache (15 females; mean age=31.9 years). Results showed that individuals with chronic headache reported having significantly more immediate family members who complained about experiencing headache compared to headache-free controls. The authors concluded that participants with chronic headache were more likely to be exposed to a pain model than those without a chronic pain condition.

Violon and Giurgea (1984) compared a group of 40 adults (24 females; mean age=50.8 years) with a variety of chronic pain conditions receiving acupuncture treatment to 50 adults (19 females; mean age=46.3 years) who were receiving treatment at a university clinic for a chronic but pain-free disease. Results showed that adults with chronic pain were significantly more likely to report having at least one family member

with a chronic pain condition (not necessarily the same chronic pain condition of the respondent). The authors offered both biological and psychological explanations for this relation, speculating that families with pain problems were able to transmit "abnormal illness behaviour" to their children via either greater pain sensitivity, or more opportunities for learning about pain from affected family members.

Ehde, Holm, and Metzger (1991) compared a sample of 42 university students with recurrent migraine (at least one episode per month) and 43 students with recurrent tension headache (at least three episodes per week) to 59 headache-free controls on a number of measures of family functioning and family pain history. Participants from either of the headache groups were not necessarily receiving medical treatment for their headaches. Results showed that students with headache recalled having significantly more familial pain models, defined as a family member who frequently displayed pain and illness behaviour, and more models whose pain disrupted family functioning. Participants in the headache groups also reported significantly more headache models and more intense pain associated with these models than those without headache. Although a number of cautionary statements about the correlational nature of these data were made by the authors, the study's conclusions suggested that social learning processes such as observational learning may play an important role in the development and maintenance of recurrent headache.

These three studies all examined the likelihood of having a family member with chronic or recurrent pain among adults with various pain problems and conditions. Results were fairly consistent in showing that adults with chronic pain are more likely to report

having an immediate family member with a similar pain condition. However, none of these studies directly questioned the other family members themselves, and the possibility of a reporting bias among the respondents was not addressed. All of these studies examined whether or not family members had pain and did not determine whether there was, in effect, a "dose-response" relationship between family members' pain and respondents' pain. That is, the studies did not examine whether more severe pain in family members was related to more severe pain in the respondent, or whether exposure to a larger number of family members with pain increased the risk to the respondent.

Children with Chronic or Recurrent Pain

It has also been shown in numerous studies that children with either a chronic or recurrent pain condition are more likely to have parents who report similar pain problems (e.g., Apley & Naish, 1958; Apley, 1975). In a retrospective epidemiological study of recurrent stomachache in preschool aged children, Zuckerman, Stevenson, and Bailey (1987) reported that 3-year-old children with recurrent stomachache were more likely to have mothers who described their own health as poor. Although this study did not present a clear picture of how a pain problem may be transmitted from a parent to a child, the authors suggested that the role played by parental modeling of pain is deserving of closer empirical investigation.

Other studies have demonstrated that children with recurrent abdominal pain are more likely to be exposed to salient pain models than are children with abdominal pain which has an identified organic basis or healthy, pain-free children. For example,

Wasserman, Whitington, and Rivara (1988) examined school functioning, family environment, stressful events, as well as the presence of family members who had a history of abdominal pain in a sample of 31 children (18 girls; mean age=10.6 years) who were referred for medical evaluation at a pediatric gastroenterology clinic for nonspecific recurrent abdominal pain. A control group of 31 children (18 girls, mean age=10.4 years) who were either classmates of the children with pain (n=29) or healthy children from a similar socioeconomic background obtained from the practice of a local pediatrician (n=2). Parents of children with recurrent abdominal pain were significantly more likely to report a history of peptic ulcer disease than parents of control children. Nearly one third of children with recurrent abdominal pain had a family member currently receiving treatment for peptic ulcers or spastic colon. No differences were found between groups on measures of externalizing behaviours, social competence, or measures of family functioning. Children with recurrent abdominal pain were rated by their parents as displaying more internalizing behaviours. The authors concluded that presence of recurrent abdominal pain in children was likely related to a combination of genetic predisposition to abdominal pain, a tendency to internalize feelings of distress, and an environment present with more pain models.

Bennett-Osborne, Hatcher and Richtsmeier (1989) compared 20 African-American children (8 female; mean age=10.2 years) with recurrent pain resulting from sickle-cell disease to 20 African-American children (13 females; mean age=10.3 years) with recurrent pain in the abdomen or chest for which no organic cause could be detected. Children with recurrent abdominal/chest pain and their parents identified more pain models who were salient to the child than children with sickle-cell pain and their parents. Children with

recurrent abdominal/chest pain were also more likely to report positive or neutral

consequences resulting from their complaints of pain, whereas children with sickle-cell

pain were more likely to report negative consequences resulting from their pain. It is not

clear whether differences in pain severity between the children with recurrent

abdominal/chest pain and children with sickle-cell pain may have accounted for differences

in their perceptions of consequences as positive or negative. These findings provide

additional evidence that the presence of a salient pain model, one of the hypothesized

necessary conditions of social learning, is related to increased likelihood of having

recurrent pain of unexplained origin. Had the consequences of the pain models of the

unexplained pain group also been identified as either positive or neutral, a stronger case

supporting modeling of pain would have been made.

Routh and Ernst (1984) compared 20 children with "functional" abdominal pain

(11 male; age range=8 to 15 years; mean age=11.8 years), defined as abdominal pain for

which no medical cause could be identified, to 20 children with organically-based

abdominal pain resulting from a distinct medical ailment such as gastritis (12 male; age

range =7 to 17 years; mean age=12.9 years) on their total number of first- and second-

degree biological relatives who had somatization disorder. Information was obtained using

a structured interview with mothers of children which was developed from the National

Institute of Mental Health Diagnostic Interview Schedule - Version III (Robins, Helzer,

Croughan, Williams, & Spitzer, 1981). The interviewer was blind to the study hypotheses

and group membership of the mothers and children. A first degree relative was defined as

the biological mother, father, and any full siblings of the target child. Second degree

relatives included half siblings, nieces and nephews, aunts, uncles, and grandparents of the target child. Mothers of children with functional pain identified a significantly greater number of family members with somatization disorder than mothers of children with organically-based pain (14/325 compared to 1/319, respectively). This study did not address the mechanism underlying the link between functional pain in children and excessive somatizafion in family members, but concluded that this association warranted further investigation.

Robinson, Alverez, and Dodge (1990) examined the frequency of somatic complaints among parents of a sample of 40 children (19 males; all older than four years old) who were receiving treatment for recurrent abdominal pain from a hospital pediatric clinic and parents of 17 children (7 males; matched on age, sex, social class and birth order to children in the other group) with recurrent abdominal pain who were recruited from local schools who had consulted doctors about their pain, but who did not receive treatment from hospital. These data were then compared to data from a sample of 40 matched children (19 males) from a hospital dental clinic as well as to those from a sample of 40 healthy children (19 males) without abdominal pain recruited from local schools. The authors reported that the total number of symptoms reported by parents of children hospitalized for abdominal pain was higher than that of the other groups but did not use statistical analyses to support this assertion. Although they concluded that children with recurrent abdominal pain who received care from a hospital were more likely to come from families where complaints of pain from parents were frequent, this assertion is, at best, tenuous given the lack of statistical support for their claim.

Walker and her colleagues have investigated a number of factors related to pain among children with medically unexplained, recurrent abdominal pain (e.g., Garber, Zeeman, & Walker, 1990; Walker, Garber, & Greene, 1991; 1993; 1994). For example, pain characteristics among children with recurrent abdominal pain such as pain frequency, intensity, functional disability, and somatization have been shown to be related to parental variables such as pain or illness frequency, as well as encouragement of illness behaviour. These studies have made an important contribution to our understanding of the relation of family variables to children's pain and illness.

For example, Garber, Zeeman, and Walker (1990) showed that mothers of children with recurrent abdominal pain (RAP; n=13) without an identifiable organic basis were more likely to report that they had been "sickly most of their life" than were mothers of children with pain from an identifiable organic cause (n=11). Parental somatic symptoms and their relation to child pain were again examined in Walker, Garber and Greene (1991). This study examined the association between symptoms of somatization in children with RAP (n=41), children with organic abdominal pain (e.g., esophagitis, gastritis; n=28) and healthy children attending an outpatient clinic for a routine visit or acute minor illness (n=41) and severity of similar symptoms among their mothers and fathers. Results showed that children with RAP had more self-reported symptoms of somatization disorder than did the other children. Further, higher scores on the measure of somatization in children were associated with higher scores on a similar somatization inventory for both mothers and fathers, but only among mothers and fathers of children with RAP. These findings lend further support to the notion that exposure to parents with health concerns and multiple

somatic symptoms is associated with increased somatic preoccupation and symptom reporting in children, even in the absence of a clearly defined organic disease.

Walker, Garber, and Greene (1993) compared children with RAP (n=88; 54 girls), children with peptic disease (e.g., esophagitis, gastritis; n=57; 32 girls), healthy children attending an outpatient clinic for a routine visit or the emergency room for an acute minor illness (n=56; 28 girls), and children attending an outpatient psychiatry appointment (n=48; 24 girls) on measures of abdominal pain frequency, functional disability, additional somatic symptoms, anxiety, depression, life events, child perceived competence, family functioning, illness behaviour encouragement, and illness among other family members. Children were between 8 and 18 years of age; a majority of children with RAP were younger than 12 years old. Children with RAP had a significantly greater number of relatives with current or past abdominal disorders than healthy children, but no difference was noted in the number of relatives with abdominal disorders between children with RAP and children with abdominal pain from peptic disease. Further, although children with RAP reported a stronger perception of illness behaviour encouragement from their parents compared to healthy children, perceptions of illness behaviour encouragement were as strong among children with organically based pain. It appears that frequent somatic complaints and frequent exposure to illness and pain among relatives can be common features of children with pain from both identifiable and unidentifiable causes. These findings provide compelling evidence that both operant and social learning factors likely play an important role in the development and expression of recurrent pain syndromes in children.

In a prospective study examining the factors that contribute to higher levels of pain at a follow-up visit, Walker, Garber, and Greene (1994) interviewed children with organic pain (e.g., from Crohn's disease, or peptic disease; n=68), a specific pain syndrome (e.g., pain from constipation, dysmenorrhea, or irritable bowel syndrome; n=26), or a nonspecific abdominal pain syndrome for which no medical cause could be identified (n=103). Approximately 60% of participants were girls and the mean age of participants was 10.6 years (SD=2.9 years). Parents completed measures of negative life events, child competence, and their own somatic complaints. Teachers completed measures of child competence. Results showed that parental somatic symptoms and child social competence moderated the impact that negative life events had on symptom levels in children. For example, boys who reported a high number of negative life events whose mothers reported a high number of somatic symptoms during the initial interview were more likely to report higher levels of somatic symptoms at a 1-year follow-up interview than were boys with a low number of negative life events. Mothers' levels of somatic symptoms were not related to girls' levels of somatic symptoms. Fathers' somatic symptoms had a significant direct impact on both boys' and girls' levels of symptoms. These findings provide additional evidence that children with recurrent pain problems are more likely to be exposed to salient figures in their families who also have frequent pain and other somatic symptoms.

The results of these studies offer converging evidence to suggest that a child's exposure to a pain model may increase the likelihood that the child will also develop a pain problem. However, the magnitude of risk and other factors which may influence the risk associated with exposure to a pain model have not been adequately assessed. Further, the

finding that pain complaints co-occur within families of children with recurrent pain is by no means universal. For example, McGrath, Goodman, Firestone, Shipman and Peters (1983) reported that parents and siblings of children with recurrent abdominal pain had similar numbers of pain complaints when compared to children with no history of recurrent pain. Children meeting Apley's (1975) criteria for recurrent abdominal pain who were referred by their family physician to the gastroenterology service of a tertiary care children's hospital and a control group of children, matched for age and gender, who were attending other outpatient clinics for minor physical problems were recruited for participation. Although the abdominal pain group was more likely to have abdominal pain and other pain in their preschool years than children in the control group, no significant differences were noted between parents and siblings of children on measures of current pain. However, had modeling played a role in the development of pain in these children with recurrent abdominal pain, it would have been useful to question parents and siblings about their prior experience with or history of recurrent pain. The observation of, and interaction with, a parent or sibling who had recurrent pain in the past may have had a facilitating effect on the development of recurrent pain in these children.

It is very likely that factors other than simple exposure to a parent with pain are responsible for co-occurrence of pain among family members. Parental response to illness and pain has received some attention in the literature as an important variable related to children's socialization regarding health and illness (e.g., Walker & Zeeman, 1992; Walker, Garber & Van Slyke, 1995). For example, Dunn-Geier, McGrath, Rourke, Latter, and D'Astous (1986) investigated psychological variables that discriminated between

children and adolescents with recurrent, benign pain (i.e., recurrent knee pain,

stomachaches, or headaches) who were coping well, and those who were not. Children

identified as "non-copers" (n=10) had missed three or more days of school each month for

at least the past two months because of pain. Children identified as "copers" (n=10) did

not have a school absence problem. Children were videotaped while they completed a set

of physical exercises, of approximately 15 minutes in duration, which included sit-ups, arm

curls, and step-ups, while their mothers supervised. Results showed that mothers of non-

copers discouraged coping attempts of children significantly more often than mothers of

copers. This finding suggests that coping with pain, an important pain-related

characteristic, may be operantly conditioned. This conclusion is even more compelling

given that no differences were noted between groups on a prospective measure of pain

frequency and intensity during the one week between study appointments. Thus, the

differences between groups could not be attributed to differences due to amount or

intensity of pain.

Walker and her colleagues have also investigated parental response to child illness

behaviour in an attempt to determine whether operant factors, directly attributed to

parents' behaviour, are responsible for differences in behaviour and symptoms among

children with both organically-based and medically unexplained pain (e.g., Walker &

Zeeman, 1992; Walker, Garber & Van Slyke, 1995). The Illness Behavior Encourgement

Scale is a 24-item self-report measure developed by Walker and Zeeman (1992) to

measure the extent of encouragement of the sick role by parents for both gastrointestinal

symptoms and cold symptoms in children. Respondents rate how often each item, which

describes some aspect of illness behaviour encouragement (e.g., "How often do your parents let you stay home from school when you have symptom?"), occurs on a 5-point rating scale (never, hardly ever, sometimes, often, always). Parents and children complete the same questions about parents' behaviour for each type of symptom. Results of this study, describing the development of this scale, found that girls perceived more encouragement of the sick role than did boys, but that parents did not report giving different amounts of encouragement to daughters compared to sons. However, fathers reported less frequent encouragement than did mothers. Other studies using this measure have shown that illness behaviour encouragement by parents decreases with increasing child age (Walker, Garber, & Greene, 1993). This tool may help researchers better understand the social learning factors that possibly underlie the shaping and development of pain-related symptom reporting, disability, and handicap. It is very likely that both operant and social learning factors work together to determine behaviour, but the precise nature of these relations is poorly understood.

Walker, Garber, and Van Slyke (1995) examined hypothetical parental reactions to vignettes depicting misbehaviour among children with: (1) medically explained organic abdominal pain; (2) symptoms of depression; (3) abdominal pain not associated with a medical diagnosis; or (4) healthy, symptoms-free children. Participants included 360 parents (160 mothers; mean age = 44.9 years) with at least one biological, adopted, or step child older than two years. For each illness type, vignettes depicted either an 8-year-old or a 16-year-old child, and children were described as either male or female by using gender-specific names (i.e., Mary or John). Participants rated questions regarding their

attributions for cause and responsibility for the behaviour, blame for the misbehaviour, and consequences for the misbehaviour on a 7-point Likert type scale. Results showed that misbehaviour of children with organically-based abdominal pain was more likely to be excused than that of children depicted in the three other vignettes. Adults had significantly fewer negative attributions and negative reactions toward children described as having organically-based abdominal pain. A possible conclusion of this study is that children with medically explained pain are more likely to have their pain and illness complaints negatively reinforced by obtaining a reduction of negative parent-child interaction.

The majority of these studies suggest that children who have recurrent pain problems are more likely to have parents or other salient family members who also have recurrent pain problems. It is plausible that parental modeling of pain behaviour and symptom reporting underlies this increased rate of co-occurrence. However, there is also a possibility that genetic or constitutional similarities within families underlie the physiological propensity to have pain. For example, a strong familial occurrence of migraine has been reported in the headache literature (Larsson, Bille, & Pedersen, 1995; McGrath & Larsson, 1997). Although the influences of the physiological and the psychological factors on a complex behaviour pattern such as pain response are impossible to tease apart, it is likely that they have their own unique contribution. It is also likely, however, that social learning processes have a greater influence on the subjective expression of pain, particularly in terms of the development of pain-related disability and handicap, than it would on the underlying physiology. By definition, pain is a subjective biopsychosocial experience comprised of cognitive, affective, sensory and behavioural

components (International Association for the Study of Pain; Merskey & Bogduk, 1994). Although there is clearly a physiological substrate to pain, pain perception and expression involve a number of complex subjective responses which have been shown to be influenced by the presence of social models in adults (Craig & Prkachin, 1978; Patrick, Craig, & Prkachin, 1986). As such, there is considerable converging evidence which suggests that social learning factors, in particular modeling, have a direct impact on pain perception and expression.

Modeling and Experimental Pain

A number of laboratory analog studies have demonstrated that social models may influence the subjective experience and expression of pain in adults. For example, Craig and Prkachin (1978) demonstrated that healthy female undergraduates (n=20) conformed to tolerant models in verbal reports of pain during an experimental procedure that induced pain using electric shock. Participants were paired with a female confederate, who did not actually receive shocks, but whose ratings were 25% lower than the participants (Craig & Prkachin, 1978). Participants rated pain intensity using a numerical rating scale (1=no pain; 100=painful). Results showed that participants paired with a tolerant model had significantly lower pain ratings compared with participants paired with a control model, who simply observed the experiment.

Similar findings have been found when pain tolerance is examined. Thelen and Fry (1981) examined the combined effects of modeling and selective attention on pain tolerance during a cold pressor task (1° to 2 °C). Participants included a sample of 98

healthy undergraduate students (48 males) who were randomly assigned to one of seven

experimental conditions (n=14 per group; selective attention instructions; modeling;

combined selective attention and modeling; selective attention, modeling, and with

suggestions of helpful cognitions; a no instruction control; demand placed on participant

by the experimenter to perform well; and expectations of longer tolerance during the

second immersion). Participants completed two cold pressor tasks where they were

instructed to keep their arm in the water for as long as possible. The first cold pressor task

provided a baseline measure of tolerance. Tolerance was determined by the amount of

time (measured in seconds) that the participant could keep his or her arm in the water.

Pain intensity was measured also, using a numerical rating scale with verbal anchors (0=no

pain, 6=extremely painful). During the break between cold pressor trials (210 seconds),

the experimental manipulation was administered. Results showed that those who received

manipulations which provided exposure to a tolerant model (provided through videotape)

had greater pain tolerance during the second cold pressor test as indexed by difference

scores compared to the first immersion. No differences were noted between groups on

ratings of pain intensity. No gender differences were noted across groups, but this null

finding may be the result of lack of statistical power. These results suggest that modeling

is an important variable for determining reactions to pain but that other psychological

variables may also play a role.

Craig and Patrick (1985) examined the impact of exposure to social models who

showed tolerance or intolerance to pain on pain-related facial expression during a cold

pressor paradigm. Female university undergraduates (n=72; mean age=18.6 years) were

randomly assigned to one of three experimental conditions. Those assigned to the "tolerant" condition completed the cold water immersion concurrently with a model, who had lower ratings of pain and less pain-related facial expression. Those assigned to the "intolerant" condition also completed the cold water immersion concurrently with a model who had higher ratings and depicted a "pained" face throughout the immersion. In the control condition, the participant was instructed that the model would observe her immersion and then complete a cold water immersion. Results showed that participants self-reported pain intensity generally conformed to the respective model to which they were exposed. Their facial behaviour did not, however, conform to that of the model's.

In a similar study, Patrick, Craig, and Prkachin (1986) showed that female volunteers (n=30) exposed to tolerant models reported levels of pain equivalent to those reported by subjects exposed to intolerant models, despite receiving higher levels of shock. However, untrained observers attributed greater pain to subjects exposed to tolerant models who received shocks of greater intensity, than to subjects exposed to intolerant models, suggesting that the social modeling effect may have had a specific effect on verbal reports of pain that did not extend to ratings of observable pain-behaviour. The similarities observed between confederates' and subjects' experience of pain were observed in the absence of any tangible secondary gain or reward and occurred despite the fact that the model, a stranger to the participants of the experiment, was likely somewhat less salient to the participants than a parental figure.

It has also been shown that natural variations in pain threshold and pain behaviour can influence the pain behaviour of others (Prkachin & Craig, 1986). Rather than using

models who behaved according to a relatively strict role with a limited range of behaviours, this study contrasted female undergraduate students identified as having a low pain threshold (n=40) with students identified as having a high pain threshold (n=42) during a pain induction procedure using electric shock. Results showed that high threshold students exposed to the behaviour of a low-threshold participant was likely to produce increased pain intensity.

These studies offer further evidence that modeling is a powerful psychological mechanism which can alter the expression and experience of pain in individuals. No research has yet examined whether a child's behaviour during an experimental pain procedure conforms to models depicting varying levels of pain. Only one study has examined the relation between parents' pain and children's pain during an experimental pain induction paradigm (cold pressor pain; Thastum, Zachariae, Bjerring, & Herlin, 1997), In fact, very little research has been conducted using experimental methods of pain induction with children. However, recent research has suggested that the cold pressor test is an ethical and suitable measure of pain in children and adolescents (e.g., Zeltzer, Fanurik, & LeBaron, 1989; Miller, Barr, & Young, 1994). This paradigm could therefore be used to determine whether a child's pain behaviour and self-reported pain intensity conforms to a parent's pain behaviour and pain intensity.

The Present Research

The purpose of the present research was to examine the relations among variables related to a parents' pain experience, such as the frequency and severity of pain

complaints, impact of pain episodes on daily functioning, pain catastrophizing, and observed pain behaviour to similar variables in their children. Two studies were carried out, each examining these relations using different methodologies. The first study examined, prospectively, the relative risk of having a parent with frequent, severe, or disabling pain complaints on the frequency and severity of pain complaints in a child in a community sample of families. The second study examined whether a mother's pain behaviour during a cold pressor task had an impact on her child's pain behaviour and ratings of pain intensity during a similar task. Findings of this research will provide evidence regarding the relative importance of a parent's pain behaviour on the overall experience of pain in their child

CHAPTER 2. STUDY 1: METHOD

The aim of Study 1 was to determine the degree of concordance in the number and severity of pain incidents among children and parents in a community sample of families. Characteristics of each pain incident, including location, duration, intensity, associated disability and medication use, that occurred during a 7-day period were recorded by each participant on a daily basis. Data were recorded prospectively and self-report data were obtained from both children and parents.

Differences by Age and Gender

Relative risk of the parent's pain on a child's pain was examined, controlling for several key variables that may be related to pain, including age of the child and gender of both parent and child.

Hypothesis (a): Mothers were expected to report significantly more pain incidents, significantly more pain identified as clinically severe, and more pain incidents classified as disabling compared to fathers.

Hypothesis (b): Female children were expected to report significantly more pain incidents, significantly more pain indexed as severe, and more pain incidents classified as disabling compared to male children.

Hypothesis (c): The number of pain incidents, pain incidents identified as severe, and pain incidents classified as disabling were expected to increase with the age of the child. Given the restricted range of the large majority of participating parents, age differences were not expected for mothers or fathers.

Primary Hypotheses

Based on the literature reviewed proposing parental modelling as an important psychological mechanism, several predictions were made.

Hypothesis (a): Parents who reported a large number of pain incidents relative to other members of their own family category (i.e., mother or father) would be more likely to have children who reported a large number of pain incidents.

Hypothesis (b): Parents who reported a large number of severe incidents during the study period relative to their family category (i.e., mother or father) would be more likely to have children who reported a large number of severe incidents.

Hypothesis (c): Parents who reported disabling pain incidents, that is pain incidents that interfered with their daily functioning, would be more likely to have children who reported disabling pain incidents.

Method

Participants

Ethics. This study was approved by the Human Ethics Committee of the Faculty of Graduate Studies at Dalhousie University.

Recruitment. Participants included a random sample of families currently living in the Metropolitan Halifax area (i.e., Halifax, Dartmouth, Bedford, and Sackville, Nova Scotia) contacted during the period of April 26, - June 10, 1993, inclusive. For the purpose of this study, a family was defined as at least one parent with at least one child between the ages of 8 and 18 years currently living in the home. Once this initial criterion

of at least one parent and one child between the ages of 8 and 18 years was met, other eligible participants included any child who was at least eight years old and currently living in the home or any other adult currently living in the home. The nature of the relationship of other participants to the targeted parent did not exclude other participants. Children who were at least seven years of age, but not yet eight years of age were deemed eligible to participate if the targeted parent believed that the child understood how to complete the self-report measures used in the study. Participants were also required to understand written English, although it was not required that English was the first language.

Names and telephone numbers of participating families were obtained from the April, 1993 edition of the Maritime Tel & Tel Directory for Metropolitan Halifax (White Pages). The directory was divided into 11 sections, each with an equal number of pages. Each section was assigned to a trained telephone recruiter. Using a random number table to generate the page of the directory and the last digit of the telephone number to be dialed, the telephone recruiter selected target names from their section of the directory. Business and facsimile numbers were excluded.

Approximately 30, 000 telephone calls were placed by the trained telephone recruiters reaching 2, 080 eligible households. Of these, 1, 623 families agreed to participate, resulting in an initial participation rate of 78%. Of the 1, 623 families who were mailed an information package, 570 families later withdrew from participating. An additional number of 360 families expressed an intention to complete the study, but despite at least five follow-up calls and three written reminders, these families did not complete the study. Six hundred and ninety-three families comprised of 2, 242 individual

participants returned completed packages, resulting in an overall return rate of 43%. Families who completed the study had a mean of 3.6 participating members (SD=1.1) and ranged in size from two to nine participating members. Only 15 families (2.2%) had more than three participating children. Data from the parent(s) and the first three participating children (where applicable) were entered for analysis.

Participants included: 663 mothers (M age=40.8 years; SD =5.6; range=26.7 - 65.5), 484 fathers (M age=42.6 years; SD=5.8; range = 24.5 - 72.1), 553 daughters (M age=12.8 years; SD=3.7; range = 7.0 - 27.6) and 541 sons (M age=13.1; SD=3.8; range = 7.1 - 26.0). The large majority of participating children were 18 years of age or younger. (n=523 daughters, 94.6%; n=521 sons, 96.1%). A small proportion of the participating "parents" were actually grandparents or other relatives who were the primary caregivers for participating children (24 grandmothers, 10 grandfathers, 1 aunt, 1 uncle).

The majority of participating fathers were employed at least on a part-time basis (n=459, 95.6%; in 4 cases, this information was not reported). Fathers reported working an average of 43.7 hours per week (SD=14.6 hours). Forty-nine fathers (10.4%) reported completing less than high school. Eighty-two fathers (17.3%) reported completing high school. Seventy-four (15.6%) fathers reported completing part of or all of a community college program. One hundred and fifty (31.7%) fathers reported completing part of or all of a university undergraduate program. One hundred and seventeen (24.7%) fathers reported completing a professional or graduate level training program. The proportion of fathers with professional or graduate level training appears to be quite high, however, it could be that this large number is due, in part, to a rather broad interpretation of the word

"professional". For example, participants were noted to have identified training in a specific trade (e.g., carpentry, surveying, secretarial work) as professional training.

The majority of participating mothers were also employed, at least on a part-time basis (n=628, 91.9%). Mothers reported working an average of 23.7 hours per week (SD=15.8 hours). Sixty mothers (9.2%) reported completing less than high school. Eighty-two mothers (23.2%) reported completing high school. One hundred and twenty-one (18.6%) mothers reported completing part or all of a community college program. One hundred and ninety-one (29.3%) mothers reported completing part or all of a university undergraduate program. One hundred and twenty-nine (19.8%) mothers reported completing a professional or graduate level training program. Once again, this proportion was noted to be relatively high, and was likely related to a broad interpretation of the word "professional".

Measures

The measures used in this study were contained within a 10-page booklet. There were four different types of booklets, one for adult females, adult males, female children and male children (see Appendix A for an example). Booklets for adults and children differed only in the response choices under the category Work Leisure and Exercise. For all booklets, the first page described the nature and purpose of the study to participants. The second and third pages asked participants about demographic information, occupational or educational activities as applicable, leisure activities, self-reported health problems, and regular medication usage. Medication usage that occurred on a regular

basis was described as either every day, every week, every month, or following some other

regularly occurring schedule. The fourth page consisted of the Daily Pain Diary, where

participants were instructed to check the appropriate box to indicate whether they had

pain on a given day and whether they sought medical treatment for each episode of pain.

All participants were instructed to complete a Pain Report Form, located at the

back of each booklet, for each incident of pain they reported during the 7-day study

period. The Pain Report Form asked detailed questions about the location, cause,

duration, and intensity of pain for each incident of pain they had on a given day. Location

of pain was recorded by marking an 'X' on the corresponding location on a line drawing

of a gender-neutral human figure. Cause of pain was assessed through an open-ended

question asking participants what they thought caused the pain. Duration of pain was

assessed using a 4-item forced-choice question about how long the pain lasted. Response

choices for this question were: 1-30 minutes; 30 minutes-3 hours; 3-12 hours; 12-24

hours. Intensity of pain was assessed using the Faces Pain Scale developed and validated

by Bieri, Reeve, Champion, and Addicoat (1990). This 7-item scale asks respondents to

circle the face that best describes their pain. The scale begins with a face depicting a

neutral expression and the amount of distress/discomfort each face depicts increases

gradually. The Pain Report Form also asked whether any medication was taken for the

pain and how much pain relief the participant attributed to the medication.

Functional Disability Inventory. Participants were also asked to complete the

Functional Disability Inventory (FDI; Walker & Greene, 1991), titled Activity Inventory in

the booklet, to assess the impact of each incident of pain on daily activities. The FDI was

originally designed to measure difficulty with physical and psychosocial functioning related to physical health in children. Walker and Greene (1991) reported that this measure had high levels of internal consistency, 3-month test-retest reliability that exceeded 0.60 for children with recurrent abdominal pain, and significant correlations in the moderate range with a measure of school absence and somatic symptoms. Although the FDI was designed and pretested for use with children, the items of the FDI tap psychosocial and physical domains which are universal, applying to both children and adults (e.g., walking, eating, socializing, engaging in leisure or sport activities, etc.). For this reason, the FDI was used to assess pain-related disability and handicap in both children and adults, to avoid using two different questionnaires. For the purpose of this study, participants were asked to complete the FDI about each incident of pain that they reported in their diaries.

The measures which comprised the Pain Diary have been pretested in two pilot studies. These pretests showed that children as young as eight years old could understand the instructions and complete the required information without assistance from a parent.

Procedure

During each telephone call, the recruiter, following a standard script (Appendix B), attempted to reach the target person who was selected from the telephone directory. If the target person did not appear to be an adult (e.g., in cases where a child's telephone line was selected), the recruiter asked to speak with a parent. Once an adult target person was reached, the recruiter explained that they were calling on behalf of the Pain Research Laboratory at Dalhousie University and that this laboratory was conducting a study

examining the occurrence of pain in families with children between the ages of 8 and 18 years currently living in the home. If the living situation of the person who answered did not meet the inclusion criteria for the study, she or he was thanked and the call was terminated. If the target person who answered was a member of a family with children currently living in the home, the nature and purpose of the study were explained in more detail. If the target person expressed interest in the study, the following information was recorded: name, age, gender, and address of target person; name, age, gender, and nature of relationship to target person of each adult living in the home (e.g., husband, brother-in-law, aunt, etc.); name, age, gender, and nature of relationship to target person of each child between the ages of 8 and 18 years living in the home (e.g., daughter, son, niece, etc.) .

A package containing a Pain Diary for each eligible member of the target person's household was then mailed to the target person. In this package, a letter explaining the nature and purpose of the study in detail (Appendix C) was also included. This letter was to be returned to the laboratory with their completed diaries in the mail. Participants were instructed to record each episode of pain that they experienced each day during a 7-day period in their diaries. Members of the same family were asked to complete the diaries for the same one-week period. Additional Pain Report Forms were included with each diary.

Packages also contained pre-stamped, addressed return envelopes and additional Pain Report Forms. To enhance compliance, a follow-up call was placed one week after the initial recruitment telephone call to ensure safe arrival of the package, and to answer potential questions about completing the pain diaries. A second follow-up call was placed

two weeks after the initial follow-up call to remind families to return their packages. Follow-up calls, placed at 2-week intervals continued until families returned their packages or informed the recruiter that they were no longer interested in participating in the study. Of those families who did not return their diaries, a minimum of five follow-up calls were placed to each household. A reminder letter was also sent out to families who had not returned their diaries within two months of being enrolled in the study. A second written reminder in the form of a brief post-card was also sent one month after the first written reminder. In a final attempt to encourage families to complete and return their diaries, non-responding families were notified approximately six months after being enrolled in the study that the names of families who returned their completed diaries within the next month would be entered into a draw where they would be eligible to win one of four cash prizes of $50.00. Of the 360 families notified of this incentive, only 6 returned packages.

CHAPTER 3. STUDY 1: RESULTS

Results

Data were entered using a double-entry procedure with SPSS® Data Entry II and analysed using SPSS® for Windows™ v6.0 (SPSS Inc., 1993). Each 'X' marked on the human figure in the Pain Report Form was coded as a distinct incident of pain. The distribution and prevalence of pain reports by family group and location for the entire sample are presented in Table 1.

Insert Table 1 About Here

Three outcome variables were created for subsequent analyses. These included: (1) total number of pain incidents; (2) total number of clinically severe pain incidents, defined as incidents where the severity rating equaled or exceeded the third face on the Faces Pain Scale (Bieri et al., 1990) and which lasted three hours or longer; (3) and total number of disabling pain incidents, which included pain incidents where the average disability item rating equalled or exceeded 1 SD above the mean item rating. Incidents were termed "clinically severe" for several reasons. Research with children has used a similar intensity rating on the Bieri et al. scale to help determine when children should be given appropriate analgesia for post-operative pain (Gauthier, Finley, & McGrath, 1998). The duration criterion of three hours or longer was selected because it was likely that pain episodes of at least this duration would be associated with more severe pain characteristics, and these incidents would be more likely to have an impact on the behaviour of the affected

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individual. Descriptive statistics are presented for each of these outcome variables.

Cut points for each of these variables for each family group were established by determining the value that exceeded the 75ᵗʰ percentile for a particular variable and family group. Dichotomous variables were then computed based on those who did and did not exceed the cut point (75ᵗʰ percentile). Multiple logistic regression was then used to determine a child's risk of exceeding the cut point on any of these variables based on a set of predictor variables which included child age, child gender, and parental pain variables. Logistic regression is ideally suited to predicting the presence or absence of a characteristic as it is similar to a linear regression model. Estimates of risk associated with each of the independent variables in the model can then be determined from the regression coefficients. To maintain the assumption of independence of samples, the remaining analyses were conducted using data from the mother, the father, and one participating child from each family. Selection of this participating child was random.

Total Number of Pain Incidents

The mean number of pain incidents reported during the study period by family category for mothers, fathers, and the first participating child is presented in Table 2.

Insert Table 2 About Here

A one-way analysis of variance (ANOVA) showed that the mean number of pain incidents differed across family category, $F(3, 1840)=8.74$, $p < 0.001$. Orthogonal comparisons

showed that mothers ($\underline{M}$=3.8; $\underline{SD}$=4.8; range=0-36) reported significantly more incidents

of pain than fathers ($\underline{M}$=3.2; $\underline{SD}$=4.9; range=0-51; t(1,1840)=2.24, p< 0.05. No difference

was observed in the number of incidents reported by mothers and daughters ($\underline{M}$ =3.3;

$\underline{SD}$=3.4; range=0-24; t(1,1840)=1.69, ns), but daughters reported significantly more

incidents than sons ($\underline{M}$=2.3, $\underline{SD}$=2.4; range=0-21; t(1,1840)=3.21, p < 0.01).

Participants were identified as having a large total number of pain incidents if their

total number of pain incidents exceeded the 75th percentile for their family category. The

cut point for all family categories for total number of pain incidents was 4. That is,

mothers, fathers, and participating children were identified as having a large total number

of pain incidents if their total number of pain incidents recorded during the 7-day study

period exceeded 4. Tables 3 and 4 show the results of logistic regression analyses and the

relative risk (RR) in children for reporting a large number of pain incidents during the 7-

day study period, controlling for age and gender of the child. Risk factors identified

included the age of the parent, and whether parents reported a large number of pain

incidents. Analyses examining risk associated with mothers' pain (Table 3) and fathers'

pain (Table 4) were conducted separately so that the children who only had one parent

(i.e., mother or father) participating were not excluded from the analyses due to missing

variables.

Insert Tables 3 and 4 About Here

In both analyses, daughters were at significantly greater risk for reporting a large total number of pain incidents than sons. Neither age of the child nor age of the parent had any impact on risk. Children whose parents reported a large number of pain incidents were at significantly greater risk for also reporting a large number of pain incidents than children whose parents did not report a large number of pain reports. The magnitude of risk of having a parent with a large number of pain incidents did not change as a function of child gender.

Pearson correlations were calculated showing small, but significant relations between the total number of pain incidents reported by mothers and daughters (r=0.14, p=0.005) and between mothers and sons (r=0.14, p=0.022). A small positive correlation was also found between the total number of pain incidents of fathers and daughters (r=0.19, p=0.001). The correlation between total number of incidents for fathers and sons was not significant (r=0.09, p=0.295).

Clinically Severe Pain Incidents

Each incident of pain was classified as being clinically severe if the intensity rating equalled or exceeded the third face on the Faces Pain Scale (Bieri et al., 1990) and lasted three hours or longer. The distribution of clinically severe pain incidents by family category is presented in Table 5.

Insert Table 5 About Here

A one-way ANOVA showed that the mean number of clinically severe pain incidents was significantly different across family category, $F(3, 1770)=15.61$, $p < 0.001$. Orthogonal comparisons showed that mothers ($\underline{M}=1.97$; $\underline{SD}=4.2$; range=0-36) reported significantly more clinically severe incidents of pain than fathers ($\underline{M}=1.05$; $\underline{SD}=2.89$; range=0-28; $t(1, 1770)=4.70$, $p < 0.001$). Daughters ($\underline{M}=1.21$; $\underline{SD}=2.61$; range=0-24) reported significantly more clinically significant incidents than sons ($\underline{M}=0.55$; $\underline{SD}=1.36$; range=0-12; $t(1, 1770)= 2.63$, $p < 0.01$).

Participants were identified as having a large number of clinically severe pain incidents if their total number of clinically severe incidents exceeded the 75th percentile for their family category. A mother was identified as having a large number of clinically severe reports if her total number of clinically significant pain reports exceeded 2. Similarly, a father was identified as having a large number of clinically severe pain incidents if his total number of clinically severe reports exceeded 1. Children were identified as having a large number of clinically severe reports if their total number of reports exceeded 1.

Tables 6 and 7 show results of logistic regression analyses estimating the relative risk (RR) in children for reporting a large number of clinically severe pain incidents during the 7-day study period (i.e., greater than 1), controlling for age and gender of the child. Risk factors included the age of the parent, and whether parents reported a large number of pain incidents. Again, analyses examining risk associated with mothers' pain (Table 6) and fathers' (Table 7) pain were conducted separately so that children with only one participating parent were not excluded from the analyses.

Insert Tables 6 and 7 About Here

Daughters were at significantly more risk for reporting a large number of clinically severe pain incidents than sons. In both analyses, girls were more than twice as likely than boys to report a large number of clinically severe pain incidents. For each one year increase in age, risk of reporting more than one clinically severe pain incident increased by approximately 15% for daughters and sons. Age of the parent was not significantly related to increased risk for the child. Children whose parents reported a large number of clinically severe pain incidents were at increased risk for also reporting a large number of clinically severe pain incidents (3.4 times more likely when exposed to a mother and 3.5 times more likely when exposed to a father). However, when mothers' pain was specified as a risk factor, the nature of risk associated with mothers' pain changed as a function of child gender. The risk of having a large number of clinically severe pain incidents was no different for girls who had or did not have a mother with a large number of clinically severe incidents. However, boys whose mother had a large number of clinically severe incidents were almost three times as likely to have a large number of clinically severe incidents than boys who did not.

Pearson correlations were calculated between the total number of clinically severe pain incidents reported by mothers, fathers, daughters and sons. There was no relation between the total number of clinically severe incidents reported by mothers and daughters ($r=0.01$, $p=0.783$) and between mothers and sons ($r=0.09$, $p=0.165$). A small positive

correlation was found between the total number of clinically severe pain incidents of fathers and sons ($r=0.23$, $p=0.000$). The correlation between total number of incidents for fathers and daughters was not significant ($r=0.06$, $p=0.414$).

Disabling Pain Incidents

Pain-related disability and handicap was measured using the Functional Disability Inventory (FDI; Walker & Greene, 1991). Each item describes a routine, daily activity such as "Walking to the bathroom". The participant was asked to rate how much trouble she or he had doing the activity because of the incident of pain on a scale of 0 (no trouble) to 4 (impossible). Rather than using a total score for this measure, mean item ratings were calculated because of the large number of items that were left unanswered by study participants. The mean FDI ratings reported by fathers was 0.69 ($SD=0.72$), by mothers was 0.90 ($SD=0.81$), and by children was 0.55 ($SD=0.61$). These mean ratings show that, on average, participants reported having between "no trouble" (i.e., a rating of 0) and "a little trouble" (i.e., a rating of 1) with the activities described in this scale. A disabling pain incident was defined as an incident where the average item rating equalled or exceeded 1 SD above the mean item rating. The mean number of disabling pain incidents reported by mothers was 0.47 ($SD=2.10$; range=0-26) and by fathers was 0.48 ($SD=2.67$; range=0-32). There was no difference in the number of disabling pain incidents reported by daughters ($M=0.42$; $SD=1.61$; range=0-24) and sons ($M=0.23$; $SD=0.72$; range=0-12; $t(1,487.64)=1.92$, $p=0.06$ (note: variances were significantly different).

Participants were identified as having a large number of disabling pain incidents if their total number of disabling incidents exceeded the 75th percentile for their family category. The cut point for all family categories for disabling pain incidents was 0, suggesting that the large majority of incidents were not indexed as disabling. Tables 8 and 9 show logistic regression analyses estimating the relative risk (*RR*) in children for reporting 1 or more disabling pain incidents during the 7-day study period, controlling for age and gender of the child. Risk factors included the age of the parent, and whether parents reported any pain incidents indexed as disabling.

Insert Tables 8 and 9 About Here

There was no difference observed in risk for daughters compared to sons for reporting disabling pain incidents. For each one year increase in age in children, risk increased by approximately 7 to 11%, depending on whether the sample of children with mothers was examined versus children with fathers. Age of the parent did not affect risk. Children whose parents reported disabling pain incidents were at significantly more risk for also reporting disabling pain incidents than children whose parents did not report disabling pain incidents (2.3 times more likely when exposed to a mother and 2.1 times more likely when exposed to a father). Risk of having a parent with disabling pain incidents did not change as a function of child gender.

CHAPTER 4. STUDY 1: DISCUSSION

These results provide clear evidence that pain and pain-related disability reported by parents are associated with an increased risk of pain and disability in their children. Although previous research has suggested that pain complaints may co-occur or cluster within families (e.g., Turkat et al., 1984; Ehde et al., 1991, Zuckerman et al., 1987), much of this research has been based on retrospective accounts and has used participants with recurrent or chronic painful conditions. The bulk of this research has also relied on samples recruited from medical clinics and often did not obtain the self-report of both children or parents. This is the first prospective, epidemiologic study of pain complaints to use self-reported data from both parents and their children. Results of this study provide evidence that pain complaints tend to co-occur among family members in the general population, which allows more widely generalizable conclusions to be drawn regarding the clustering of pain complaints within families. For instance, the conclusions of the present study are not limited to a specific painful condition, but can be generalized to pain incidents or pain episodes, in general.

Empirical support was found for all three hypotheses. Each hypothesis will be examined, the findings which support or refute each hypothesis will be reviewed, and possible explanations will be given to clarify the meaning of each finding. It is likely that similar mechanisms underlie these findings. As such, a general discussion of these is provided after each hypothesis is examined.

Total Number of Pain Incidents

The hypotheses of this study proposed that mothers would report significantly more pain incidents than fathers and that daughters would report significantly more pain incidents than sons. Clear support was found for both of these hypotheses. The mean number of pain incidents reported by mothers was significantly higher than the mean number reported by fathers. Similarly, the mean number of pain incidents reported by daughters was significantly higher than the mean number reported by sons. These findings show that, across different types of pain and pain of different levels of severity, female children reported experiencing pain more often than did male children and that women (i.e., mothers) report experiencing pain more often than did men (i.e., fathers).

While these findings answer a very important question regarding differences between the amount of pain reported by male and female adults and children, they do not provide answers to other more specific questions. For example, we did not examine differences between mothers, fathers, daughters, and sons in the number of incidents of head pain, or back pain, or differences between groups in the number of incidents due to accidental injury. The number of possibilities regarding the manner in which these data could have been analysed is enormous. While it would have been scientifically relevant to provide a more fine-grained analysis of the nature of these differences to answer other questions, it is important to recall that the primary purpose of this study was to determine, in the broadest sense, whether pain complaints co-occurred among family members. For this reason, all analyses were conducted using data from all types of pain.

The hypotheses also proposed that children whose parents reported a large

number of pain incidents during the study period would be more likely to also report a large number of painful incidents. Support was also found for this hypothesis. In the study sample, children whose mothers' total number of pain incidents exceeded the 75th percentile (i.e., reported more than 4 incidents during the 7-day study period) were 2.1 times more likely to also report a total number of pain incidents which exceeded the 75th percentile. Girls were approximately 1.4 times more likely to report a large number of incidents than boys. Similar findings were observed when the same analysis was completed examining fathers' total number of pain incidents as a risk factor. Children whose fathers' total number of pain incidents exceeded the 75th percentile were 2.0 times more likely to also report a total number of pain incidents which exceeded the 75th percentile. These results confirm that children whose parents reported a large number of pain incidents during the study period are at higher risk for also reporting a large number of pain incidents.

These findings are especially compelling when considering the small Pearson correlations between the number of pain incidents reported by parents and children. Pearson correlations computed between the total number of pain incidents for mothers and daughters, mothers and sons, fathers and daughters, and fathers and sons showed weak relations between these variables. Correlations ranged from $r=0.09$, $p=ns$, between fathers and sons to $r=0.19$, $p=0.001$ between fathers and daughters. These results suggest that there is only a very small relation between parental pain and child pain. The results of logistic regression analyses offer a clearer picture of the variables that are predictive of reporting a large number of pain incidents.

Clinically Severe Pain Incidents

The hypotheses regarding the relative distribution of clinically severe pain incidents also suggested that mothers would report significantly more clinically severe pain incidents than fathers and that daughters would report significantly more clinically severe pain incidents than sons. Full support was found for each of these hypotheses. The mean number of clinically severe pain incidents reported by mothers was significantly higher than the mean number reported by fathers. Similarly, the mean number of clinically severe pain incidents reported by daughters was significantly higher than that reported by sons. These findings provide evidence that, across types of pain, female children reported experiencing clinically severe pain more often than did male children, and that women reported experiencing clinically severe pain more often than did men.

A prediction was also made that children whose parents reported a relatively large number of clinically severe pain incidents during the study period would be more likely to also report a large number of clinically severe incidents. Support was also found for this hypothesis. Children whose mothers' total number of clinically severe pain incidents exceeded the 75th percentile (i.e., mothers who reported 3 or more clinically severe incidents during the 7-day study period) were 3.4 times more likely to report a large number of clinically severe incidents (i.e., two or more clinically severe pain incidents). Girls were approximately 1.6 times more likely to report a large number of incidents than boys. It is interesting to note, however, that the magnitude of risk changed as a function of child gender. Examination of the interaction term in the regression model showed that boys exposed to a mother who had a large number of clinically severe incidents were at

greater risk for also reporting a large number of clinically severe incidents. Mothers' pain did not have an impact on girls' pain. This pattern was not observed when fathers' pain was identified as a risk factor, nor was it observed when risk was examined as a function of exposure to a large number of pain incidents. It is difficult to draw conclusions about the nature of this interaction without there being a consistent pattern. Child age was also identified as a significant risk factor. For each 1 year increase in the age of the child, risk of reporting two or more clinically severe pain incidents increased by approximately 15%.

Similar findings were observed when the same analysis was completed examining whether fathers reported a large number of clinically severe pain incidents (i.e., two or more clinically severe incidents) as a risk factor. Children whose fathers' total number of pain incidents exceeded the 75th percentile were 3.7 times more likely to also report a total number of pain incidents which exceeded the 75th percentile. These results confirm that children whose parents reported a large number of clinically severe pain incidents during the study period were at higher risk for also reporting a large number of clinically severe pain incidents. Girls were approximately 1.5 times more likely to report a large number of clinically severe incidents compared to boys. Child age was also identified as a significant risk factor. For each 1 year increase in age, risk of reporting two or more clinically severe pain incidents increased by approximately 16%.

Overall, these results suggest that children who were exposed to parents who frequently reported clinically severe pain (i.e., 3 or more episodes per week for mothers and 2 or more episodes per week for fathers) were more likely to also report frequently occurring clinically severe pain (i.e., 2 or more episodes per week). As in the analyses

examining the factors which are predictive of reporting a large number of pain incidents, these analyses show that the outcome of modeling, that is, the co-occurrence of clinically severe pain incidents, was observed in the general population. The risk of co-occurrence associated with similar types of pain, or pain from specific causes have not yet been determined. For example, the present study did not examine whether a parent who reported clinically severe pain in the legs placed their child at increased risk of also reporting clinically severe pain in the legs. However, these data demonstrate that in the very broadest sense, across type of pain or purported cause of pain, children whose parents reported a large number of pain incidents or a large number of clinically severe incidents were at increased risk of also reporting a large number of pain incidents or a large number of clinically severe incidents.

Disabling Pain Incidents

The large majority of pain incidents reported by participants, regardless of family category (i.e., mother, father, daughter, son), were associated with very little disability. The average rating for the items on the Functional Disability Inventory across all pain incidents was less than 1 on a 0-4 rating scale (0=no trouble; 4=impossible). Disabling incidents were defined as pain incidents with an average rating on the Functional Disability Inventory equal to or greater than 1 SD above the mean. For example, for mothers, a disabling incident was one where at least, "some trouble" (item rating=2) was reported for most of the items and "a little trouble" (item rating=1) was reported for the remaining items. A disabling incident for fathers and children was reflective of slightly lower ratings,

and subsequently less disability. In practical terms, these analyses captured risk associated with reporting relatively mild disability associated with a pain incident.

Unlike the analyses presented for total number of pain incidents and total number of clinically severe incidents, risk of reporting a disabling pain incident was not different for daughters compared to sons. This null finding may be related to the way in which disability was operationally defined, in that it generally captured only mild disability. A 7% to 11% increase in risk of reporting a disabling pain incident was observed with a one year increase in age. Children whose parents reported disabling pain incidents were generally twice as likely to report a disabling incident compared to those children whose parents did not report a disabling incident. Risk did not change as a function of child gender. This finding shows that even exposure to mild disability in a parent was associated with increased risk of disability in a child.

The three sets of analyses which examined the risk associated with total number of pain incidents, total number of clinically severe incidents, and disabling pain incidents all were dependent on the way in which "caseness" was determined. The determination of caseness allowed the examination of risk associated with the presence of a specific set of criteria. The goal of this study was to determine the risk associated with having more pain incidents (or more disability) than average, relative to the entire sample. Therefore, the 75th percentile for each of the three variables of interest was chosen as the cut point to define "caseness", rather than using a more clinically based definition of caseness (e.g., the diagnostic criteria for migraine). The criteria used to define caseness in the present study allows these findings to have a more broad application, and do not limit the

generalizability of findings to those individuals with a painful and perhaps clinically relevant condition (e.g., migraine or recurrent abdominal pain).

It is likely that similar mechanisms underlie all three sets of findings. Parents who typically report large numbers of pain incidents (or large numbers of clinically severe pain incidents) have provided their children with many more opportunities to learn about how to behave when in pain, than parents who typically do not have pain incidents. This finding also concurs with the findings of previous research. For example, there have been several studies which have shown that children whose parents report high levels of somatic complaints are more likely to also have increased somatic complaints themselves (e.g., Walker et al., 1993; Walker et al., 1994). However, as noted previously, many of these studies have been conducted in tertiary care clinics, and it may be that parents with excessive somatic complaints are more likely to pursue medical treatment for their children than healthy parents. It is unlikely that children simply observed their parents recording pain incidents in their pain diaries in the present study because both parents and children were instructed to keep the information in their diaries private. The results are more likely reflective of learned patterns of behaviour related to health and symptom reporting.

Because the modeling of a behaviour is a complex process, rather than a discrete event, it is unlikely that definitive evidence proving causality can be obtained. Rather, evidence can be accumulated that supports modeling as a potential "mode of transmission" for reporting pain. Modeling, however, is not the only explanation that can account for these relations. Shared environment and genetic predisposition may also play a role.

Gender differences were found in the total number of pain incidents reported and in the number of clinically severe incidents reported, but not in the number of disabling incidents reported. There is some evidence that girls are at increased risk for pain than boys, especially in older age groups (e.g., Goodman & McGrath, 1991; Unruh, 1996). Similarly, there is some evidence that girls are encouraged to display greater levels of illness behaviour than boys. (Walker & Zeeman, 1992). In this study, we examined risk for reporting one (or more) disabling pain incident(s) during a one-week period. Gender differences in pain-related disability may become more apparent when more severe disability is examined.

The way in which families were recruited may also have affect the findings of this study. Families were recruited by telephone and those who did not have a telephone were not eligible for participation. The decision to recruit by telephone likely reduced the number of low-income families in the sample. Indeed, the descriptive information regarding the educational level and employment of adult participants confirmed that this sample was well educated, and that most families had at least one adult in the family employed.

The rate of recruitment and rate of final participation may have also affected the results. The initial participation rate of families who initially agreed to participate and who had study materials mailed to their home was 78%. This rate of participation is well within acceptable limits for a study of this size. However, the final participation rate of families who returned completed study materials by mail was only 43%. It may have been that families with more frequent pain were more interested in the nature of the study, and that

these families were more likely to complete study materials. However, completing study materials required some degree of effort for those participating. It would require much more time and effort for those with frequent, multiple pain complaints compared to no pain. It is also possible that these two factors affected the rate of participation for the study.

This research is an important first step in examining the factors related to reporting pain incidents in families with children. These findings provide support to the commonly held notion that pain "runs in families" (e.g., Apley, 1975). Because the present study did not examine clinical pain conditions such as migraine or recurrent abdominal pain, the results provide evidence that the degree of concordance between parents and children can occur along a continuum, with relevance to both clinical pain conditions and pain incidents, as well as to everyday pain experiences. Reporting a pain incident, reporting pain characteristics (e.g., intensity, severity, etc.), or pain-related disability are learned behaviours, although they are clearly learned in the context of constitutional or genetic influences. It is therefore likely, that at least some of the variance associated with co-occurrence between a parent and child is related to social learning factors. The next step in examining how social learning factors affect pain in healthy children could be to experimentally manipulate the degree of concordance of pain characteristics between parents and children. The second study of this research investigates the effect of maternal modeling of tolerance or intolerance to an experimental pain induction paradigm on pain threshold, pain tolerance, pain intensity, and observed pain-related facial behaviour.

CHAPTER 5. STUDY 2: INTRODUCTION

The first study showed that a statistically significant concordance existed between both number of pain reports and severity of pain reports between parents and children for families in which parents report either a large number of reports, a large number of severe reports, or a large number of disabling reports. This second study attempted to manipulate the degree of concordance in self-reported pain intensity, self-reported pain threshold, and observed pain behaviour between mothers and children during a cold pressor pain induction paradigm using modeling by mothers to alter pain expression in children.

The cold pressor test is a classic experimental paradigm of pain perception in which a participant immerses the forearm up to the elbow in a bath of cold water (e.g., Hilgard et al., 1974; Wolff, 1994; Gracely, 1994; Harris & Rollman, 1983). Several subjective measures of the pain resulting from the cold pressor test are possible. Threshold is typically defined by the point at which pain sensations first become noticed by the participant and is usually assessed by determining the amount of time that elapses between immersion and the point at which a participant first notices pain. Tolerance is another subjective reaction to pain usually defined as the point when the participant terminates the immersion because he or she can no longer tolerate the sensations from the cold water (Wolff, 1994). It is usually measured by determining the amount of time between the point of immersion and point of withdrawal from the water. Self-reported pain intensity can also be assessed using a variety of methods including a visual analogue or numerical rating scale.

The cold pressor paradigm was initially developed for use with adults. Water temperature is usually maintained between 1°C and 4°C, but other temperature levels, such as 0°C, 5°C, and 10°C have also been used (e.g., Hilgard, et al., 1974). This paradigm has been used much less commonly with children. There are only a handful of published studies which have examined children's reactions to cold pressor pain (e.g., Feuerstein, Barr, Francour, Houle & Rafman, 1982; LeBaron, Zeltzer, & Fanurik, 1989; Zeltzer, Fanurik, & LeBaron, 1989; Fanurik, Zeltzer, Roberts, & Blount, 1993; Miller, Barr, & Young, 1994). This lack of published research is likely due to a combination of ethical issues and methodological factors.

Research ethics guidelines[1] provide a framework of stringent criteria against which researchers can evaluate their designs and methods to maximize scientific advancement and minimize harm to participants. In a compelling editorial, McGrath (1993) examined the ethical issues involved in inducing pain in children to answer research questions about children's pain experience. She noted that the criteria for evaluating whether a particular study involving children is ethical are the same, regardless of whether the research question pertains to experimental or clinical pain. This editorial emphasized that the relevance of the research question and the integrity of the research design (i.e., sample size justification, estimation of power, selection of reliable and valid measures) were equally important factors to consider, in addition to informed consent by parents, child assent,

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[1]

For example, the *Report on Research Involving Children* prepared by the Consent Panel Task Force of the National Council on Bioethics in Human Research (NCBHR), May, 1992 or *Guidelines on Research Involving Human Subjects* prepared by the Medical Research Council of Canada, 1987.

voluntary withdrawal without penalty, and a proper balance of harm and benefit to the participants. Placing undue importance on minimizing harm by preventing exposure to noxious and/or pain causing stimuli to children during controlled research studies, without also considering the importance and relevance of other criteria, would likely stymy efforts to better understand an important aspect of children's pain.

The cold pressor paradigm is ideally suited to examine reactions of children to pain because it minimizes the risk of harm (both physical and psychological). Preliminary research has shown that a water temperature of 10°C is cold enough to reliably produce discomfort during a cold pressor task (Fanurik, Zeltzer, Roberts, & Blount, 1993). The child is under complete control of exposure to the stimulus. The discomfort associated with cold water rapidly dissipates once the arm is removed from the cold water bath and exposure to water at that temperature for a brief period (up to four minutes; Miller, Barr, & Young, 1994) does not cause tissue damage. In the majority of cases, the cold water does not produce an entirely new sensation or experience. To ensure this factor, researchers can set minimum age limits for experimental pain, so that the pain induction procedure does not introduce new pain sensations to the child, but produces sensations that have already been experienced through regular activities (McGrath, 1993) such as through making snowballs without mittens, or by looking for seashells in Atlantic tidal pools. Children as young as six years of age have participated in cold pressor pain induction paradigms (e.g., Zeltzer, Fanurik, & LeBaron, 1989). However, a minimum age also allows for a better understanding of what participating in the research study entails. The older the child, the more likely that informed assent closely approximates informed

consent.

The few studies which have been published provide excellent examples of how the cold pressor paradigm can be used to answer important research questions about pain in children, while adhering to basic research ethics guidelines. LeBaron, Zeltzer, and Fanurik (1989) was the first study to critically evaluate the experimental and clinical utility of using the cold pressor paradigm with children (although it was not the first published study to use the cold pressor test with children). A convenience sample of children (n=37; age range = 6-12 years) recruited from a private elementary school participated in two cold pressor experiments, three months apart. The first was an immersion in 15°C water and the second was in 12°C water. Both immersions lasted up to 40 seconds, unless children removed their arm beforehand. Children rated how "uncomfortable" their arm was while in the water at 10 second intervals using a 1-10 numerical rating scale (1= "not at all uncomfortable"; 10= "so uncomfortable that I need to take my arm out"), although children were allowed to use numbers greater than 10 if they wished to indicate even greater discomfort. Children were instructed to leave their arm in the water for as long as they could, but told that they could remove their arm from the water at any point during the experiment. Immersions were completed using both arms for both water temperatures. This study noted a number of nonsignificant trends for age and gender differences. For example, girls tended to have higher pain ratings than boys across both water temperatures, although no difference was noted between the number of boys and girls who withdrew their arm from the water before the 40 seconds had elapsed. Further, pain ratings in the 12°C water tended ($p<0.06$) to be higher for older children than for

younger children. However, 6 of the 14 younger children withdrew both arms before the

40 seconds had elapsed, and only 1 of the 15 older children withdrew early. The relatively

small sample size precluded the ability to examine the interactive effects of age and

gender.

Although few definitive conclusions regarding the children's pain experience could

be offered, the authors addressed several of the crucial methodological and ethical

concerns that likely precluded previous research. For example, they showed that

discomfort was produced in a majority (but not all) of participants with a water

temperature of 12°C and 15°C which is many degrees warmer than that used in the

majority of studies with adults. This water temperature was also much warmer than that

used in Feuerstein, Barr, Fancoeur, Houle, and Rafman (1982), which was between 0°C

and 1°C. LeBaron, Zeltzer, and Fanurik (1989) also noted that this method of pain

induction was acceptable to parents and children alike. Children were able to provide

estimates of pain intensity, threshold, and could also provide information on many of the

sensory qualities of pain. They concluded that the cold pressor paradigm was a suitable

and ethical measure of pain perception in children, and that it had tremendous potential as

a method of addressing research questions regarding developmental changes and age

differences in response to pain.

Zeltzer, Fanurik, and LeBaron (1989) subsequently examined whether a

psychological intervention (hypnosis) could be used to reduce pain sensations produced by

the cold pressor test. A convenience sample of 37 children (the same sample as described

in the previous study) participated. Children were identified as being either low in hypnotic

susceptibility (n=12) or high in susceptibility (n=25) using a standardized screening

questionnaire (Morgan & Hilgard, 1973). Children participated in two cold pressor tests,

spaced three months apart with water temperatures of 15°C (n=37) and 12°C (n=29). The

hypnosis intervention consisted of having the child imagine an activity that was fun or

exciting, with the assistance of the examiner, 30 to 90 seconds prior to the cold pressor

test. Children's self-report ratings of pain intensity were significantly lower for those who

participated in the hypnosis intervention than those in the control condition. The hypnotic

intervention did not appear to have an impact on whether children were able to leave their

arm in the cold water for the maximum time of 40 seconds. This study provided important

evidence to show that the cold pressor test is a useful method for evaluating the influence

of psychological variables on experimental pain in children.

Fanurik, Zeltzer, Roberts, and Blount (1993) also evaluated the effectiveness of

psychological interventions for cold pressor pain in children. A convenience sample of 60

healthy children (n=22 boys; age range=8-10 years), recruited from a local elementary

school, participated in a cold pressor test with a water temperature of 10°C for up to 240

seconds. Children's spontaneous coping strategies in response to a baseline cold pressor

test were assessed during an interview about what the children thought of or did to help

them keep their arm in the water for as long as possible. Based on this interview, children

were classified as either "attenders", who directed their attention toward the sensory or

emotional aspects of the experience or "distractors", who directed their attention away

from the sensory or emotional aspects of the immersion. Children were then randomly

assigned to receive training in a psychological intervention (imagery or sensory focusing),

or to a brief social-contact control condition. Results showed that children who used

distraction during the baseline condition had lower pain ratings when using imagery than

those children who were identified as attenders. This study demonstrated that the

effectiveness of psychological interventions could be assessed using the cold pressor test,

and that this test allowed the impact of individual differences on psychological

interventions to be examined.

Miller, Barr, and Young (1994) examined whether holding a solution of intraoral

sucrose would produce analgesic effects in school-aged children during a cold pressor test.

A convenience sample of 42 healthy children (23 males; age range=8-11 years)

participated in two cold pressor tests, two days apart, both using 10°C water for up to

four minutes in duration. On one occasion, participants held a solution of 24% sucrose in

their mouths during the cold pressor test, while on another, they held plain mineral water.

Self-reported threshold was determined by the number of seconds that participants held

their arm in the water prior to indicating the onset of pain via a hand gesture. Self-

reported ratings of intensity of sensation were obtained every 30 seconds using a 10 cm

visual analogue scale with verbal anchors "least strong" and "most strong". Tolerance was

measured by the number of seconds that participants were able to keep their arm in the

water bath.

The length of time that elapsed prior to participants indicating threshold was

significantly longer for the sucrose condition compared to the control condition; on

average, children receiving sucrose indicated threshold approximately 4.6 seconds later

than those receiving the control liquid. No difference was noted between the sucrose and

control conditions on the measure of tolerance or on visual analogue scale ratings of strength of sensation. Although some support for the analgesic effect of intraoral sucrose was noted, this study provided further evidence that the cold pressor test is a useful research tool that can be used to address important questions about the sensory and affective qualities of children's pain.

One group of researchers has used a modified cold pressor task with a water temperature of 10 °C as a means of evaluating the usefulness of specific interventions to improve coping with brief but painful medical or dental procedures in 8- to 11-year-old children (Coldwell, et al., 1998). This modified cold pressor task used nine 10- to 240-second immersions separated by 30-second rest periods as an analogue to medical or dental procedures which cause repeated discomfort and which last between 15 to 45 minutes (e.g., scaling). Preliminary results have shown that instruction in positive coping was associated with less pain.

Although research experience using the cold pressor test with children is still very limited, the studies which have been published to date provide enough data to warrant continued research using this paradigm. These studies have demonstrated that parents will provide informed consent for their child to participate, that children will assent to participate, and that cold water maintained between 10°C and 15°C reliably produces discomfort in a majority of children, but that it is a discomfort that they willingly agree to experience. This tool has tremendous potential to answer difficult questions about children's responses to pain provided that the necessary ethical guidelines are followed.

Only one published study has examined the relation between child pain and

parental pain during a cold pressor task (Thastum, Zachariae, Bjerring, & Herlin, 1997).

This study compared the pain threshold, pain tolerance, and mean pain intensity reported

by 9- to 15-year-old children with juvenile rheumatoid arthritis (n = 15; M age = 11.8

years) and their parents to a group of healthy children (n = 25; M age = 10.4 years) and

their parents during a cold pressor task. The water temperature was set at 6 °C for

children and 1 °C for parents. The mean pain tolerance for young, healthy children (aged 9

- 11 years) was significantly longer than that of young children with arthritis (aged 9 - 11

years). No difference between healthy children and children with arthritis was observed in

the pain tolerance of older children. Similarly, young children with arthritis had a

significantly lower pain threshold compared to young healthy children. No between group

difference was noted for older children with respect to pain threshold. No differences were

observed in mean pain intensity ratings between healthy children and children with

arthritis, or between older and younger children. Moderate correlations were observed

between healthy children and their parents on pain intensity ($r = 0.42, p < 0.05$) and pain

tolerance ($r = 0.53, p < 0.01$). Moderate correlations were also observed between children

with arthritis and their parents on pain intensity ($r = 0.45, p < 0.05$) and pain tolerance ($r

= 0.38, p > 0.05$). Correlations between parents and children for pain threshold were not

significant for either groups. This study is important in that it used an experimental pain

paradigm to examine differences in pain perception between healthy children and children

with a chronic, painful disease. It also was the first to examine the relation between child

and parental pain using an experimental pain methodology.

Very little research has examined the psychological variables which affect children's pain induced by the cold pressor test, such as mood, anxiety, or family factors. Pain catastrophizing is a psychological construct which has recently begun to receive attention in the adult pain literature as an important variable in predicting pain during experimental paradigms employing the cold pressor test. Pain catastrophizing is often viewed as a negative appraisal of pain that is trait-like and which is characterized by ruminative thinking which cognitively magnifies pain sensations (in part, by drawing attention to them) and which evokes feelings of helplessness (Sullivan, Bishop, & Pivik, 1995). Catastrophizing has also been demonstrated to predict pain significantly beyond the effects of measures of negative affect such as depression and anxiety (e.g., Sullivan, Bishop, & Pivik, 1995).

Only one study has examined how pain catastrophizing is related to pain experiences in children during a cold pressor test (Thastum, Zachariae, Bjerring, & Herlin, 1997). This study used the Catastrophizing subscale of the Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983) and reported moderate, positive correlations between pain catastrophizing and pain intensity ($r=0.32$) and negative correlations between pain catastrophizing and pain tolerance ($r=-0.41$). It is likely that children who report high levels of pain catastrophizing will experience more intense pain during a cold pressor test.

Present Research

     The present research sought to determine whether observing a parent's reaction during a cold pressor test (in vivo) would have an impact on a child's pain behaviour and ratings of pain intensity during a similar cold pressor test. Pairs of mothers and children were randomly assigned to one of three experimental conditions. Without their child being aware, mothers were instructed to either exaggerate their display of pain-related facial behaviour and to indicate low levels of pain threshold or to minimize their display of pain-related facial behaviour and to indicate longer levels of pain threshold. Instructions regarding facial behaviour were provided via a videotape of models behaving in the appropriate manner. A third group was assigned to a no instruction control group and were given no specific instructions about facial behaviour or ratings of threshold. Those assigned to the control condition watched a videotape which provided more details about the design of the cold pressor apparatus. All groups were instructed to rate the pain intensity as they actually experienced it. Mothers completed a 240-second cold pressor test in 10°C (± 1°) water using the non-dominant arm while their children observed. Children then completed the same cold pressor test while their mothers observed. Threshold was assessed by asking participants to make a hand gesture the moment they experienced any painful sensations. Self-reported ratings of pain intensity were obtained from mothers and children using a numerical rating scale (0-10). Tolerance was defined as the length of time participants left their arm immersed in water, to a maximum of 240 seconds. Measures of other psychological variables including state and trait anxiety, pain catastrophizing, as well as operant factors that may be related to symptom reporting such

as parental encouragement of illness behaviour were also obtained prior to the cold

pressor test.

Primary Hypotheses

Based on the literature reviewed that pain behaviour and pain intensity ratings

conform to those of an observed model (e.g., Patrick, Craig, & Prkachin,1986; Craig &

Patrick ,1985), and that the frequency, severity, and degree of disability associated with

pain complaints have been observed to co-occur within families (Goodman, McGrath, &

Forward, 1997; see Study 1), it was predicted that children's self-reported pain threshold

would be lower in the "exaggerated pain" condition compared to the "minimized pain" and

control conditions. It was also predicted that children's self-reported pain threshold would

be higher in the "minimized pain" condition compared to the "exaggerated pain" and

control conditions. It was also hypothesized that children's ratings of pain intensity and

displayed pain behaviour would be higher in the exaggerated pain condition compared to

the minimized pain and control conditions. Similarly, it was hypothesized that children's

ratings of pain intensity and displayed pain behaviour would be lower in the minimized

pain condition compared to the exaggerated pain and control conditions.

Several other variables were assessed as part of this experiment prior to the cold

pressor test. Measures of state and trait anxiety (both adult and child versions of

inventories published by Spielberger et al., 1973; 1983) were obtained for both mothers

and children to determine whether psychological distress was related to self-reported pain

intensity, threshold, and observed pain behaviour. Pain catastrophizing has received

recent attention in the literature as being a better predictor of pain (i.e., accounting for a larger proportion of the variance) than other measures of distress among adults. Pain catastrophizing was also examined to determine whether it was related to child pain intensity and pain behaviour. Mothers and children also completed the Illness Behavior Encouragement Scale (Walker & Zeeman, 1992) to determine whether concordance in self-reported pain intensity and threshold, as well as observed pain behaviour between mothers and children were related to encouragement of illness behaviour.

CHAPTER 6. STUDY 2: METHOD

Method

Participants

This study was approved by the Human Ethics Committee of the Faculty of

Graduate Studies at Dalhousie University, and participants were treated in accordance

with the Medical Research Council of Canada's (1987) *Guidelines on Research Involving*

Human Subjects (1987). Participant recruitment was conducted from the data base

described in detail in Study 1.

Power Analysis. Before participant recruitment, a power analysis was conducted in

order to determine how many participants were necessary to reject a false null hypothesis.

The primary analyses planned were based on a repeated measures analysis of variance with

experimental group and child gender as the two independent variables of interest and Child

Facial Coding Scores (Chambers et al., 1996) and self-report ratings of pain intensity as

dependent variables (two separate analyses were planned). The significance criterion used

in the power analysis was set at $\alpha=0.05$, and the desired power was set at 0.80. The

population effect size was determined to be 0.40, which is a large effect size according to

Cohen (1992). According to Cohen's tables for analysis of variance, with a total of six

groups (i.e., three groups each for boys and girls), a total of 14 participants per group are

required. The present study recruited 16 participants per group for a total of 96

participants.

Several studies have shown that women are more likely to report higher pain

intensity ratings and lower tolerance levels than men during cold water immersion tasks

(e.g., Levine & De Simone, 1991; Westcott et al., 1977), but other studies have found no gender differences in pain intensity or tolerance ratings (e.g., Jaremko, et al., 1983; Dolce et al., 1986). Because of the potential for interaction effects between mothers, fathers, sons, and daughters, only mothers were included in this study.

Evidence regarding gender differences among school aged children during experimental pain and pain from medical procedures (e.g., venepuncture, immunization) is somewhat mixed. For example, Fowler-Kerry and Lander (1991) reported no difference between boys and girls in self-reported pain intensity during venepuncture among children aged 5 to 17 years. Howerver, males were likely to underestimate pain intensity, whereas females were more likely to overestimate pain intensity. Based on the results of Study 1 that female children are more likely to report episodes of pain, and episodes of clinically severe pain, it was predicted that female children will report more intense pain and display more pain-related facial activity than male children.

Study Eligibility. To be eligible to participate, mothers and children were required to meet several criteria. Children were required to be between the ages of 10 years, 0 months and 14 years, 11 months and currently living with the participating mother. Participants were required to speak English fluently. They had to be in good general health (i.e., free from any chronic medical condition[2]) without a current or past history of any chronic or recurrent pain problem (e.g., rheumatoid arthritis, Crohn's disease, fibromyalgia) or history of painful disease (e.g., cancer). They also had to be free from medical conditions which may affect circulation such as Reynaud's Syndrome, or diabetes,

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[2]Children with asthma were not excluded from participating.

and have no history of frostbite on the nondominant arm or hand. Those who were currently taking centrally acting medication on a regular basis (e.g., medication for seizure disorders, stimulant medication for behavioural or attention disorders, medication for depression, etc.) were also excluded. Mothers and children were also excluded from participating if they had any other condition that the mother was concerned might be exacerbated by the cold pressor test. Mothers were excluded if they were pregnant.

Recruitment. Prospective participants were informed that the investigator was interested in similarities and differences in mothers' and children's reactions to pain and discomfort. They were then informed that the investigator was specifically interested in pain induced by immersing the forearm in cold water, and that their participation would require them to take part in a cold water immersion that lasted for up to 4 minutes. The potential benefits, risks and remuneration for participation were outlined to target mothers. During this same telephone call, mothers were instructed to ask their child about whether he or she was interested in participating in the study by giving a few pertinent details (e.g., going to Dalhousie, putting their arm in cold water that might cause pain or discomfort, completing some questionnaires), but were asked to let the child decide before informing them of the token remuneration. If both parties were interested in participating, an appointment for the mother and child to visit the laboratory was then scheduled.

An information package containing a consent form and directions to the laboratory were mailed to prospective participants prior to their appointment. To enhance compliance, mothers were telephoned the day before their appointment to remind them of their appointment time and to clarify directions. During this telephone call, participants

were also given the opportunity to withdraw from the study for any reason.

The name, address, and telephone number of mothers who had children between the ages of 10 years, 0 months and 14 years, 11 months of age (at the time of recruitment) were determined from the data base of the epidemiologic study described in Study 1. A total of 491 mother-child pairs were identified. Following a standardized script (Appendix D), a trained telephone recruiter contacted prospective participants and briefly explained the nature and purpose of the present research.

The recruiter contacted (or attempted to contact) a total of 217 participants before the final number of participants was enrolled. A total of 40 of these could not be reached because the telephone number was wrong (22) or out of service (18). An additional four targets could not be reached despite at least 15 attempts over a number of different days of the week and times. Another 29 were ineligible due to medical/medication reasons (21 where the mother was excluded, 7 cases where the child was excluded, and 1 case where both the child and mother were excluded). In another four cases, the mother and child were no longer living together. In three cases, the mother reported that she did not speak English sufficiently well to complete questionnaires. In another two cases, the family was about to move out of the city. In 40 cases, either the mother or child refused (see Appendix E for the distribution of refusal reasons). Another 19 mother-daughter pairs were identified to participate and at least one phone call was placed, but the recruiter stopped trying to contact them because the target number of mother-daughter pairs (n=48) had already been reached. Two additional mother-son pairs indicated that they might be willing to participate at a later date, but the target number of participants was

reached prior to this time.

A total of 105 mother child pairs were enrolled. Five mother-child pairs withdrew before participation because of scheduling difficulties and lack of free time. Four mother-child pairs were subsequently excluded following participation for the following reasons: two mother-son pairs assigned to the "exaggerate" condition because, during the debriefing session, the mothers reported that they had misinterpreted the experimental manipulation and had removed their arm from the cold pressor tank before the four minutes had elapsed with an intent to show pain; 1 mother-son pair because child indicated a preference to use his dominant arm during the immersion because of a minor cut on the non-dominant hand; and 1 mother-daughter pair in which the mother had chronic knee pain but was so interested in the study that she wanted to participate even though her data would not be used.

The final sample included 96 mothers and 96 children (48 male, 48 female). Pairs of mothers and children were randomly assigned to one of three experimental conditions using a random number table. The first condition required mothers to exaggerate their display of pain during the cold water immersion. The second condition instructed mothers to minimize their display of pain. The third condition provided no instruction regarding how to behave during the second set of immersions.

Children ranged in age from 10 years, 4 months to 14 years, 10 months ($\underline{M}$= 12.6 years, $\underline{SD}$=1.2 years). Differences in child age were examined in a 3 x 2 (Group x Child Gender) between subjects Analysis of Variance (ANOVA). No difference was observed in Child Age by Group, $F(2, 95)=0.061$, $p=0.941$, or by Child Gender, $F(1, 95)=0.045$,

p=0.833. The Group x Child Gender interaction was not significant, $F(2,95)$=1.178, p=0.313.

A large majority of participating children were Caucasian (n=94; 98%) while one child was African-Canadian (1%) and another was Indo-Canadian (1%). Forty-eight children were first borns (50.0%), 34 (35.4%) were second borns, 10 (10.4%) were third borns, and 4 (4.2%) were fourth borns. Eighty-five (88.5%) children were right handed and 11 (11.5%) were left handed. Children were enrolled in Grades 4 through 9, with roughly equal proportions in Grade 5 (n=20; 20.8%), 6 (n=24; 25.0%), 7 (n=23; 24.0%), and 8(n=23; 24.0%). Only 2 children (2.1%) were in Grade 4, while 4 children were in Grade 9 (4.2%).

All mothers who participated in this study were the biological mothers of their participating children. Mothers ranged in age from 30 years to 50 years (M=41 years, SD=4.3 years). A One-Way ANOVA was performed to examine differences in mothers' age between experimental groups. Mothers' age did not differ significantly between groups, $F(2, 96)$=0.525, p=0.540. Ninety-four mothers were Caucasian (98%), one mother was African-Canadian (1%) and another was Indo-Canadian (1%). Eighty-five (88.5%) mothers were right handed and 11 (11.5%) were left handed. Mothers had between one and six children (M=2.3 children, SD=0.91).

Eighty-eight (91.7%) mothers were married or living in a common law relationship, one (1.0%) mother was single and had never married, and seven (7.3%) were separated or divorced. Thirty-nine (40.6%) mothers were employed full-time, 34 (35.4%) were employed part-time, and 19 (19.8%) were not currently employed. Two (2.1%) were

full-time university students and two (2.1%) were part-time university students. Fifteen

mothers (15.6%) had graduated from high school and 6 (6.3%) had completed some high

school. Twenty-seven (28.1%) mothers had completed and undergraduate university

degree and nine (9.4%) had completed some university. Twenty-one (21.9%) mothers had

completed a program or course offered through a community college and two (2.1%) had

completed some college training. Thirteen (13.5%) mothers had completed a Masters

degree from a university, two (2.1%) had completed a Ph.D. degree, and one (1.0%) had

completed a degree in medicine.

Measures

Mothers completed a demographic interview (see Appendix F) which asked them

to report on health-related variables pertaining to themselves and to the participating child

including medication usage and medical problems, other demographic variables such as

education, employment and marital status of mother, age, number of children born to

mother (including half-siblings, but excluding step- or half-siblings not currently residing

with mother and child), birth order of participating child and handedness..

Measurement of Covariates

The following measures were completed prior to the cold pressor test.

Anxiety

Participating children completed the State-Trait Anxiety Inventory for Children

(STAIC; Spielberger, Edwards, Lushene, Montuori & Platzek, 1973) and participating

mothers completed the State-Trait Anxiety Inventory for Adults (STAI; Spielberger,

Gorsuch, Lushene, Vagg & Jacobs, 1983). Both of these measures were initially

developed for research purposes to measure state and trait anxiety and possess excellent

psychometric properties. State anxiety is described as an emotional state or reaction

which exists at a given moment in time and is characterized by subjective feelings of

tension, apprehension, nervousness, and worry. Trait anxiety is a construct which refers to

relatively stable individual differences in the propensity to perceive stressful situations as

dangerous or threatening. It is often described as a personality trait which implies

differences between people in their disposition to respond to stressful situations with

varying amounts of state anxiety. The stronger the trait anxiety, the more likely that the

individual will experience more intense reactions in state anxiety in a psychologically or

otherwise threatening situation (Spielberger et al., 1983).

The STAIC is a 40-item self-report questionnaire designed to measure state and

trait anxiety among elementary school-aged children in Grades 4, 5, and 6 (see Appendix

G). Although the majority of child participants in the present study were older than

children in Grade 6, most were closer in age to children in Grade 6 than to those in high

school, which is the next closest normative group provided by the STAI. For these

reasons, children completed the STAIC rather than the STAI.

The first 20 items of the STAIC measure state anxiety and begin with the phrase "I

feel...". The respondent is instructed to describe how he or she feels "right now, at this

very moment" by choosing one of the three possible statements which indicate varying

degrees of a particular emotional response (e.g., "very calm", "calm", "not calm"; "very

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nervous", "nervous", "not nervous"). For the ten items which indicate the absence of anxiety (e.g., "calm", "rested", "happy", etc.), a response of "very" is assigned the value 1, and a response of "not" is assigned the value 3, so that lower scores indicate less anxiety (e.g., very calm = 1, calm=2, not calm=3). The ten remaining items which indicate the presence of anxiety (e.g., "nervous", "jittery", "scared", etc.) are reverse-scored before the total score is calculated. That is, a response of "very" is assigned the value 3, and a response of "not" is assigned the value 1 (e.g., very nervous=3, nervous=2, not nervous=1). A value of 2 is assigned when the child circles the middle choice of only the adjective. Total scores are obtained by summing the values assigned to each response and range from a minimum of 20 to a maximum of 60.

The next 20 items of the STAIC measure trait anxiety and are in the form of statements (e.g., "I feel troubled", "I feel shy"). The respondent is instructed to describe how he or she "usually" feels by rating how often each statement occurs with "hardly-ever", "sometimes", or "often". A value of 1 is assigned to all responses of "hardly-ever", a value of 2 is assigned to all responses of "sometimes" and a value of 3 is assigned to responses of "often". The total score is calculated by summing the values assigned to each response. Scores range from a minimum of 20 to a maximum of 60 with lower scores indicating less anxiety.

The Trait and State scales of the STAIC have been shown to have good internal consistency, with α coefficients (computed using the KR_{20} formula; n=132 boys; n=114 girls) of 0.82 for boys and 0.87 for girls for the State scale and 0.78 for boys and 0.81 for girls for the Trait scale. Eight-week test-retest reliability coefficients for girls and boys

respectively were 0.65 and 0.71 for the Trait scale and 0.31 and 0.47 for the State scale.

When this measure was being developed, significant positive correlations were noted

between scores on the STAIC Trait scale and the Children's Manifest Anxiety Scale

(r=0.75; Castaneda, McAndless, & Palermo, 1956) and the General Anxiety Scale for

Children (r=0.63; Sarason, Davidson, Lighthall, Waite, & Ruebush, 1960; c.f., Speilberger

et al., 1973). In the present study, the internal conisistency of this measure across child

gender was noted to be excellent for both the State scales (n=96; α=0.86) and the Trait

scales (n=96; α=0.83).

The STAI is a 40-item self-report questionnaire which measures state and trait

anxiety among adults (see Appendix H; Spielberger, 1983). The first 20 items of the STAI

measure state anxiety. The items each begin with the phrase "I feel..." and include 10

statements which describe emotions that reflect absence of anxiety (e.g., "comfortable",

"at ease", "secure", etc.) and 10 which reflect presence of anxiety (e.g., "upset",

"nervous", "worried", etc.). The respondent is instructed to describe how he or she feels

"right now, ..., at this very moment" by choosing one of the four possible choices to

indicate the intensity of the emotion (e.g., "not at all" , "somewhat", "moderately so",

"very much so"). Each item is given a weighted score of 1 to 4. A rating of 4 indicates a

high presence of anxiety. For the 10 items which indicate the absence of anxiety, the

scoring weights are reversed prior to calculating the total score. Total scores are obtained

by summing the values assigned to each response and range from a minimum of 20 to a

maximum of 80.

The next 20 items of the STAI measure trait anxiety and are also in the form of statements (e.g., "I feel secure", "I worry too much over something that really doesn't matter"). The respondent is instructed to describe how he or she "usually" feels by rating how often each statement occurs with "almost never", "sometimes" , "often", or "almost always" . Again, each item is given a weighted score of 1 to 4. Eleven items indicate the presence of anxiety (e.g., "I feel inadequate") and nine items reflect the absence of anxiety (e.g., "I feel pleasant"). The scoring weights for the items reflecting absence of anxiety are reversed scored before the total score is calculated by summing the values assigned to each response. Scores range from a minimum of 20 to a maximum of 80 with lower scores indicating less anxiety.

The State and Trait scales of the STAI have excellent internal consistency, with α coefficients of 0.93 for the State scale and 0.91 for the Trait scale reported for both men and women (n=1, 838; mean age=35 years; Spielberger et al., 1983). Four-week test-retest reliability coefficients for men and women, respectively were 0.71 and 0.75 for the Trait scale and 0.62 and 0.34 for the State scale. Eight-week test-retest reliability coefficients were slightly lower (Spielberger et al., 1983). Significant positive correlations were noted between scores on the STAI Trait scale and other measures of Trait anxiety for adults, ranging from 0.85 to 0.73 (Spielberger et al., 1970). In the present study, the internal consistency of this measure was noted to be excellent for both the State and Trait scales (α=0.89 and α=0.90, respectively).

Pain Catastrophizing

Mothers and children both completed the Pain Catastrophizing Scale (PCS; see Appendix I; Sullivan, Bishop, & Pivik, 1995) about their own pain experiences. Pain catastrophizing is a construct that refers to negative thoughts and feelings that are associated with pain, which are purported to worsen the pain experience (Keefe, Brown, Wallston, & Caldwell, 1989; Sullivan, Bishop, & Pivik, 1995). Pain catastrophizing involves ruminatory thoughts that magnify pain sensations and which evoke feelings of helplessness. The PCS is a brief, 13-item, self-report questionnaire which taps three distinct dimensions of catastrophizing which have been identified in the literature as being related to an exaggerated, negative orientation toward painful stimuli (e.g., Chaves & Brown, 1987; Spanos, Radtke-Bodorik, Ferguson, & Jones, 1979; Rosenstiel & Keefe, 1983). Three subscales of the PCS exists including Rumination, Magnification, and Helplessness. The four items which comprise the Rumination subscale tap the tendency to increase attentional focus on pain-related thoughts (e.g., "I keep thinking about how much it hurts."). The three items which comprise the Magnification subscale tap the tendency to exaggerate the unpleasantness associated with pain and the expectancies for negative outcomes (e.g., "I become afraid that the pain will become worse."). The six items which make up the Helplessness scale all describe the tendency to adopt a helpless orientation in coping with pain (e.g., "I feel I can't stand it anymore.").

Instructions ask the respondent to reflect upon past painful experiences and to rate the degree to which they experienced each of 13 items, which are statements describing thoughts or feelings when in pain, on a 5-point scale (0=not at all, 1=to a slight degree,

2=to a moderate degree, 3= to a great degree, and 4= all the time). Scores range from 0 to 52, with lower scores indicating less pain catastrophizing.

Examining the factor structure of the PCS in a sample of 438 university students using principal components factor analysis, Rumination, Magnification, and Helplessness, respectively accounted for 41%, 10%, and 8% of the total variance (Sullivan, Bishop, & Pivik, 1995). Moderate correlations were reported between the subscales, ranging from -0.30 to -0.50, and internal consistencies reported ranging from 0.60 to 0.87, with an overall coefficienct $\alpha=0$ .87. Test-retest reliability across a 6-week period was also adequate (r=0.75; Sullivan, Bishop, & Pivik, 1995).

In the present study, the overall internal consistency of this measure was noted to be excellent for participating mothers and children ($\alpha=0.90$ and $\alpha=0.85$, respectively). For participating mothers, the internal consistency coefficients of the Helplessness and Rumination subscales were also excellent ($\alpha=0.86$ and $\alpha=0.91$, respectively), but the α coefficient for the Magnification subscale was only 0.42. The internal consistency coefficients for the Helplessness and Rumination subscales of the participating children were 0.68 and 0.82. The α coefficient for the Magnification subscale 0.63. The reading level of the PCS was estimated to be at approximately a Grade 5 level so that the majority of participating children in the present study likely had little difficulty reading and understanding the measure.

Illness Behaviour Encouragement

The Illness Behaviour Encouragement Scale (IBES; Appendix J), parent and child

forms (Walker & Zeeman, 1992), are 12-item self-report scales in which parents and

children are asked to rate the degree to which the parent engages in behaviours which are

believed to reinforce the reporting of a particular illness. This scale was originally

developed using colds and gastrointestinal symptoms as target illnesses, but recent

research has used a modified version of this scale using pain as the target symptom (e.g.,

Gidron, McGrath, & Goodday, 1995). Response choices include "never", "hardly ever",

"sometimes", "often", and "always". The IBES has been shown to have good internal

consistency, with α coefficients ranging from 0.75 for the child-report colds questionnaire

to 0.88 for the child-report gastrointestinal scales. Significant positive correlations have

been reported between scores on the IBES and other indices of illness behaviour including

medication usage, school absence, and seeking medical treatment (Walker & Zeeman,

1992). In the present study, the overall internal consistency of this measure was noted to

be good for participating mothers and children (α=0.81 and α=0.76, respectively).

Measurement of Primary Dependent Variables

Pain Intensity

Pain intensity was measured using an 11-point numerical rating scale with values

ranging from 0 to 10 (see Appendix K). This scale was printed on slips of paper measuring

approximately 28 cm X 8 cm. The numbers which comprised the scale were printed using

a 16-point font and were spaced 2.5 cm apart. Participants were asked to rate how much

their immersed forearm hurt every 30 seconds, until they removed their arm from the

water, or until the 4-minute trial had elapsed, for a maximum of eight ratings. Participants

were instructed that a rating of "0" was to indicate "no pain at all", and that a rating of

"10" was to indicate "the worst pain you can imagine". Participants were provided with

eight ratings scales, each marked with the rating number at the top.

Pain Threshold

Pain threshold was determined by asking participants to raise their dominant hand

(i.e., the one not immersed in the cold pressor apparatus) the moment they began to feel

any pain or discomfort after lowering their forearm into the water. The number of seconds

following the immersion was recorded as pain threshold.

Pain Behaviour: Child Facial Coding System

Pain behaviour was assessed using the Child Facial Coding System (CFCS;

Chambers, Cassidy, McGrath, Gilbert, & Craig, 1996). The Child Facial Coding System is

an observational rating system of 13 discrete facial actions which was developed for use to

measure acute pain (e.g., pain from needle procedures) in preschool aged children. The

facial actions generally correspond to some of those identified in Ekman and Friesen's

(1978) Facial Action Coding System.

The present study measured only five facial actions (Brow Lower, Eye Squeeze,

Cheek Raiser, Nose Wrinkle, Upper Lip Raise). This decision was based on the research

of Prkachin (1992), which suggested that a relatively small subset of the actions described

in Ekman and Friesen's system provided the bulk of information about pain. Prkachin's

(1992) research also showed that the occurrence of these facial actions was largely

consistent across cold pressor pain, ischemic pain, pain from electric shock, and pain from

pressure among adults. The five facial actions used in the present study corresponded to

the four identified in Prkachin's (1992) research. Table 10 presents the CFCS facial

actions used in the present study as they compare to the four primary facial actions

identified in Prkachin (1992) and the corresponding Ekman and Friesen action unit

numbers.

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Insert Table 10 about Here

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This system has been used in several studies assessing pain-related facial activity in

preschool age children (e.g., pain from immunization, Cassidy et al., 1996; Breau, et al.,

1999; postoperative pain, Gilbert et al., in press) The CFCS has shown good inter-rater

reliability and evidence for its construct validity is accumulating. Although the system was

developed for use with preschool age children, there is very little difference in action units

between the original FACS (Ekman & Friesen, 1978) developed for use with adults and

the CFCS. The similarities between the action units suggest that the CFCS is

developmentally appropriate for use with older, school age children.

One undergraduate research assistant and the principal investigator were trained in

the use of the Child Facial Coding System (CFCS) according to specifications outlined in

the manual (Chambers et al., 1996) by a previously trained, reliable coder. Both coders

reached acceptable levels of reliability for each of the five facial actions of interest (i.e.,

Brow Lower, Eye Squeeze, Cheek Raiser, Nose Wrinkle, Upper Lip Raise) with the two

training tapes and the five practice tapes developed for use for this system prior to coding

any data from the present study. Specifically, the coders obtained a percent agreement

greater than 0.75 on all facial actions except Eye Squeeze; the facial action Eye Squeeze

occurred infrequently during the training tapes and a percent agreement of 0.64 was

obtained for this facial action. The calculation of percent agreement for CFCS coders was

determined using the formula outlined in Ekman and Friesen's (1978) original Facial

Action Coding System manual (% agreement = (number of actions with coder agreement

x 2) ÷ total number of actions coded). This formula excludes coders' agreement when the

facial action is absent (i.e., "non-occurrences" of facial actions) because there are typically

many more observations of the facial action being absent (i.e., intensity=0) than there are

the facial action being present (i.e., intensity=1 or 2). Including agreement on "non-

occurrences" in the calculation of percent agreement would artificially inflate the percent

agreement and overestimate the reliability of the coders.

All facial actions used in the present study required the coder to make judgements

of intensity. A rating of "0" is given when the facial action is absent in relation to the

child's neutral face. A rating of "1" is generally assigned when the facial action observed is

only slightly obvious to the coder. A rating of "2" is assigned when the facial action

appears distinctly to maximally, and is clearly obvious to the coder.

The undergraduate research assistant served as the primary coder and coded facial

activity for all participants. The principal investigator served as the reliability coder and

coded facial activity for 14 randomly selected participants (approximately 15%; seven males, seven females). Using the formula noted above, the percent agreement achieved between the primary coder and the reliability coder was greater than 0.80 for all facial actions (Brow Lower=0.82; Upper Lip Raise=0.88; Nose Wrinkler=0.82; Cheek Raiser=0.86; Eye Squeeze=1.00[3]).

Pain Behaviour: Global Ratings of Facial Activity

Three independent coders (undergraduate volunteers) also rated children's facial pain behaviour, operationally defined as the amount of pain showing on the participant's face, using a 10 cm visual analogue scale (VAS; see Appendix L). The anchors given for this rating scale were "no pain" and "worst pain imaginable". The coders rated facial pain behaviour from videotape by marking the scale line at the point which best corresponded to the facial pain behaviour of each participants. Ratings were made every 30 seconds. Each VAS rating coincided with a self-report rating of pain intensity made by participants. Coders were informed that participants were completing a cold pressor task which may cause pain. The coders were instructed to observe 30 seconds of the cold water immersion and then to rate the amount of pain that children showed on their face. Coders were blind both to the nature and purpose of the study and to the group assignment of the mother-child pairs.

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[3]

This percent agreement is based on only two occurrences of the facial action "Eye Squeeze"; these two occurrences were both captured by the primary and the reliability coder.

Apparatus

The cold pressor units (used for both the room temperature water bath and the cold pressor task) consisted of a Coleman Polylite-34 plastic cooler (52 cm long X 33 cm wide X 25 cm deep) with removable lid enclosed within a wooden box (58.5 cm X 40 cm X 32 cm). The enclosed box was mounted on a wooden stand so that it was approximately 57.5 cm high, with casters affixed to the bottom so it could be moved easily from one place to another. The cradle of the cold pressor unit, used to support the participant's arm as he or she lowered it in the water, consisted of a plastic tube bent to form a U shape that was 49 cm long and 17 cm wide. Two bands of plastic mesh, each 8 cm wide, formed supports for the arm. The cradle was mounted to the unit with hinges. A weight was attached to the end of the cradle and was mounted on a pulley so that the participant had to exert slight force to lower the cradle in the water.

A Fisher scientific thermometer, 40 cm in length (14-985 B 7148P), was used to measure the temperature of the water.

During the cold pressor task, participants were videotaped using two videorecorders. One recorder, a Panasonic Camescope S-VHS AG-455P colour camera with Super VHS videotapes, was used to record participants' faces during the cold pressor task. A character generator (Panasonic, model # VW - CGIP) was used with the videorecorder so that the video playback would be time-stamped displaying minutes, seconds, and tenths of seconds. A wall-mounted video camera (Panasonic, AG-190U-K) was connected to a Panasonic Super VHS 4-head VCR (AG-1970) and 12-inch colour video monitor (Panasonic, CT-1030 MC) which were located in an adjacent room. The

camera was operated by remote so that the experimenter could observe and record the behaviour of participants while remaining in the control room. An audio cassette player with detachable speakers (Sony, CFF-1020) was used to play the instructions for the experiment; one speaker was placed in the experiment room, and the cassette player remained in the control room so that it could be operated by the experimenter. A digital stop watch (Thermor 706) was used to measure the self-reported pain threshold of participants.

Procedure

On the day of the experiment, the nature and purpose of the experiment were briefly reviewed with the mother-child pair in an interview room designed to appear like a living room (i.e., without any experimental equipment such as video cameras or the cold pressor tank; see Appendix M for description of study to participants). Mother-child pairs were told that the aim of the study was to examine factors related to how children learn about pain. They were told that participation involved completing three questionnaires about thoughts, feelings, and behaviours when having pain, and more generally. The cold pressor task was described as requiring participants to place one of their arms in a tank of cold water for up to four minutes. They were informed that the task was designed to be unpleasant and painful, but that there was absolutely no risk of harm or injury to either participant (i.e., no lasting effects). The examiner carefully emphasized that participants could remove their arm from the water at any time, for any reason, or that they could withdraw from participating at any time. Written informed consent was obtained from

mothers and assent was obtained from children (Appendix N).

The mother-child pair was then escorted into the video control room where they watched an instructional video depicting a 12-year-old female child participating in a cold water immersion task using the same tanks as in the present study. The purpose of this video was to illustrate to participants what was required of them during the experimental trial (see Appendix N for text) and to orient them to the experiment room and cold pressor tank.

The videotaped demonstration explained that the experiment consisted of two immersion tasks: a 2-minute immersion in room temperature water (between 23 °C and 24 °C) and an immersion task that lasted up to a maximum four minutes in cold water. The video also explained that audiotaped instructions would tell participants exactly what to do during the experiment (see Appendix O). This video also informed participants of the procedure for rating the intensity of pain they felt during the cold pressor task. Every 30 seconds, the instructions asked participants, "How much does your arm hurt now?". Participants were instructed to rate how much their arm hurt at that moment using the numerical rating scale. The specific temperature of the water was not disclosed to participating children until the debriefing session, although it was provided to parents verbally during the experimental manipulation.

Once mothers and children were familiar with the nature of the task and had the opportunity to ask questions, the child was asked to return to the other room where he or she completed the three questionnaires (PCS, IBES, STAIC). The mother remained with the experimenter in the video control room. The examiner administered the demographic

interview to the mother and explained the experimental manipulation.

Mothers assigned to the "exaggerate" condition were told to slightly exaggerate their display of pain behaviour during the cold water immersion. Mothers in this group were instructed about how to behave by watching a videotape, approximately three minutes in length, that showed five women (models) showing moderate displays of pain by grimacing. This group was told to show facial pain behaviour that would be obvious to their child, but that would not cause the child to be overly concerned about the mother's level of distress or discomfort. These mothers were also instructed to indicate pain threshold within the first 10 seconds of the immersion, but to rate the pain as they actually experienced it using the numerical rating scale. The mother was instructed not to let her child know what her intensity ratings were.

Mothers assigned to the "minimize" condition were told to minimize their display of pain behaviour during the cold water immersion. They were instructed about how to behave by watching a videotape, again approximately three minutes in length, that showed five women (models) showing neutral faces, indicating minimal pain. These mothers were instructed to wait at least 10 seconds before indicating pain threshold, but to rate the pain as they actually experienced it using the numerical rating scale.

The final group of mothers consisted of a control condition that received no specific instructions about how to behave during the cold water immersion, when to indicate pain threshold, or how to rate pain intensity. They were shown a video of similar length describing the different types of research projects ongoing in the laboratory, and were given more detailed information about the cold pressor task (see Appendix P for

text).

    Once the mother understood the experimental manipulation, she returned to the interview room to complete the three self-report measures (PCS, IBES, STAI). Once all measures were completed, the mother and child entered the testing room which housed the cold pressor tanks, video cameras. A sofa was positioned directly opposite to the cold pressor tanks, about 1.5 m away, so that the mother and child could watch each other completing the cold pressor task. The mother completed the experimental trial first, consisting of the room-temperature immersion and the cold pressor task. Once the mother had completed the entire trial, the experimenter performed a manipulation check. The experimenter entered the testing room and asked the child to rate, using the numerical rating scale, how much pain the mother experienced on average during the cold pressor task. The child then completed an experimental trial.

    The mother and child were then asked to return to the interview room where the child was informed of the experimental manipulation. They were then debriefed (see Appendix Q) about the hypotheses of this research and the importance of the experimental manipulation for helping us to examine these issues. Participants were then thanked and remunerated with their choice of a either $15.00 or a t-shirt (valued at approximately $12.00).

CHAPTER 7. STUDY 2: RESULTS

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Overview

Data analyses were performed using SPSS for Windows, version 8.0 (SPSS Inc.,

1998). Null hypotheses were rejected using a p value set at 0.05, except in the case of

unplanned, multiple comparisons, where the alpha level was corrected to reflect a family

wise level of p=0.05.

Preliminary Analyses

Examination of Demographic Characteristics By Experimental Group

Prior to the completion of data analyses evaluating the primary hypotheses of this

study, preliminary analyses were carried out to examine differences between experimental

groups on a number of demographic variables. One-Way Analysis of Variance (ANOVA)

was used to examine differences in continuous variables (e.g., total number of children),

and Chi-Square analyses were used to examine differences in categorical variables (e.g.,

marital status). Because of the small number of participants from ethnic groups other than

Caucasian (i.e., 2 out of 96), formal analyses examining differences in ethnicity were not

conducted. As reported in the Participants section, no differences were observed in either

Child Age or Mother Age by Experimental Group.

No difference was observed in mothers' total number of children by Experimental

Group, $F(2,95)$=0.9334, p=0.3969. No between group differences were found for any of

the maternal categorical variables (handedness, educational level, employment status,

marital status). No between group differences were found in the proportion of children in

Grades 4 through 9, nor in the proportion born first, second, third, or fourth within their

family. However, a significant difference was found in the proportion of right and left

handed children by experimental group (χ^2 (2)=7.60, p=0.022) . Further examination of

the data showed that no left handed children were assigned to the minimize group, which

likely accounted for this significant difference. Summary data for continuous variables

(means and standard deviations) are presented in Appendix R and for categorical variables

(frequencies and percentages) are presented in Appendix S.

Manipulation Checks

Children's Perception of Mothers' Pain

As a manipulation check, children were asked to provide an overall rating of how

much pain their mother experienced during the cold water immersion using the 0 - 10

numerical scale following completion of the mother's cold water immersion. Evidence for

the success of the manipulation was obtained by examining group differences in the

children's ratings of their mother's pain. Two predictions were made. It was predicted that

children assigned to the exaggerate condition would rate their mothers as having

significantly more pain than would children in the control condition. It was also predicted

that children assigned to the minimize condition would rate their mothers as having

significantly less pain than children in the control condition.

The means and standard deviations of children's ratings of their mothers's pain are

presented in Table 11. A One-Way ANOVA showed that children's ratings of their

mother's pain differed significantly between groups ($F(2, 89)=24.375, p=0.000$).

Orthogonal comparisons showed that children assigned to the exaggerate condition

reported significantly higher ratings of their mother's pain compared to children in the

control group ($t(1, 87)=4.55, p=0.000$), and that children in the minimize group reported

significantly lower ratings compared to children in the control group ($t(1, 87)=2.31$,

$p=0.023$). These results suggest that the experimental manipulation was successful in

giving children the impression that their mothers experienced relatively more or less pain

during the cold pressor task, depending on group assignment.

Insert Table 11 about here

During the cold pressor task, mothers were instructed to rate the pain in their arm

using the numerical rating scale as they actually experienced it, and not according to how

experimental group assignment suggested they behave. Differences between groups on

mothers' pain ratings were examined in a Repeated Measures ANOVA. The eight pain

ratings made at 30-second intervals were collapsed into four summary scores by

calculating the mean pain rating for each of minute of the immersion. Mean summary

scores for mothers' pain for each minute of the experimental task by experimental grroup

are presented in Table 12. Although mothers' pain ratings changed significantly over the

course of the experiment ($F(3, 258)=26.894, p=0.000$), as expected, no significant

difference was observed between groups in mothers' mean rating of pain during the cold

pressor task, ($F(2, 89)=0.519, p=0.597$). As an exploratory measure, differences in

mothers' mean pain ratings were also examined as a function of child gender in the same

Repeated Measures ANOVA, to ensure that mothers' ratings did not change according to

whether they were in the company of a daughter or son. Mothers' pain ratings were not

significantly different as a function of Child Gender ($F(1, 86) = 0.851, p = 0.359$), and no

significant interactions were observed.

Insert Table 12 about here

Mothers' Pain Threshold

Mothers assigned to the exaggerate condition were instructed to raise their hand

to indicate the onset of any pain sensations soon after the cold pressor immersion began. It

was therefore predicted that mothers assigned to the exaggerate condition would have

lower thresholds compared to mothers assigned to the other conditions. A One-Way

ANOVA revealed a significant difference between groups ($F(2,87)=13.2, p=0.000$). As

predicted, a planned orthogonal contrast showed that mothers assigned to the exaggerate

condition ($M=10.4$, $SD=3.8$) had a significantly lower threshold compared to mothers in

the control condition ($M=39.1$, $SD=29.5$; $t(1,85)=-4.11, p=0.000$). This result suggests

that the threshold manipulation was understood and correctly executed by mothers

assigned to the exaggerate condition. No difference was observed in threshold values

between mothers in the control and minimize conditions ($M=43.4$, $SD=38.3$; t

$(1,85)=0.596, p=0.552$). Although there was reason to expect that children in the

exaggerate condition would have lower thresholds given mothers threshold behaviour, there was no evidence to predict a significant difference between the threshold of children in the control and minimize groups.

Primary Analyses

Examination of Primary Hypotheses

Children's Pain Threshold

Pain threshold was defined as the length of time that elapsed from the point of cold water immersion to the moment that any painful sensations were perceived. Children were asked to raise their hand the moment they perceived any painful sensations in their arm after immersing it in the cold water bath. Approximately 15% of children (n=16) failed to indicate threshold during the cold water immersion. Twelve of these children reported that they forgot to raise their hand when their arm first started to hurt. The remaining four children commented afterward that the cold water immersion was not painful. Of note, the mean pain ratings of these four children across the four minute immersion ranged from 0.5 to 1.2 (M=0.9, SD=0.3), while the mean pain ratings of the 12 children who forgot to indicate threshold ranged from 1.9 to 6.5 (M=3.8; SD=1.3). Children who did not indicate threshold (for either reason) were not included in subsequent threshold analyses; these participants were treated as missing cases.

No difference was observed in the proportion of children who did or did not indicate threshold by Experimental Group ($\chi^2(2)$=2.40, p=0.301) or by Child Gender

(χ^2=1.2, p=0.273). A similar comparison between children younger than 12 ½ years and older than 12 ½ years also showed no significant difference in the proportion of children who did and did not indicate threshold (χ^2 = 0.208, p = 0.648). The proportion of children indicating and not indicating threshold by Experimental Group, Child Gender, and Age Group is presented in Appendix T.

One outlier was removed prior to analyses examining differences in child threshold by Experimental Group. The threshold value of this particular outlier (190 seconds) exceeded three standard deviations above the overall mean threshold ($\underline{M}$=31.8, $\underline{SD}$=27.6). Further, examination of this child's pain ratings showed that all of the ratings exceeded 1, suggesting that the onset of pain occurred much earlier during the immersion than when threshold was reported. Consideration of these two factors provides both statistical and "logical" evidence for the removal of this outlier from further threshold analyses.

It was hypothesized that children assigned to the exaggerate condition would have significantly lower pain thresholds compared to those assigned to the minimize and control conditions. A One-Way ANOVA showed that threshold ratings differed significantly between Experimental Groups, (F(2,76)=3.38, p=0.039). Planned comparisons showed that children assigned to the Exaggerate Group ($\underline{M}$=21.7; $\underline{SD}$=3.9) reported significantly lower thresholds than did children in the Control Group ($\underline{M}$=35.6; $\underline{SD}$=21.8; t(1,76)=2.515, p=0.014). As expected, no difference was observed between the mean threshold of children assigned to the Control and the Minimize Groups ($\underline{M}$=32.2; $\underline{SD}$=4.2; t(1, 76)=0.610, p=0.544). Further, a moderate positive correlation between children's pain threshold and mother's pain threshold was observed across Groups (r=0.33,

p=0.004), showing that the threshold ratings of children and mothers were positively related.

<u>Children's Pain Tolerance</u>

Children's pain tolerance was defined as the amount of time that children could withstand leaving their arm immersed in the cold pressor apparatus. The majority of children (n=90; 93.8%) were able to leave their arm in the cold water for the full 240 second immersion. The pain tolerance of children who removed their arms prior to 240 seconds ranged from 45 to 130 seconds (M=81.5; SD=33.12). No difference was observed in the proportion of children who reached or did not reach the point of pain tolerance by Experimental Group (χ^2(2)=4.27, p=0.118) or by Child Gender (χ^2=0.00, p =1.00). A similar comparison between children younger than 12 ½ years and older than 12 ½ years also showed no significant difference in the proportion of children who reached or did not reach pain tolerance (χ^2=0.803, p=0.370). The proportion of children who reached and did not reach the point of pain tolerance by Experimental Group, Child Gender, and Age Group is presented in Appendix U. Because of the relatively small number of children who reached tolerance before the 240 second period (n=6), differences in pain ratings and observed pain behaviour were not formally examined between children who did and did not reach the point of pain tolerance.

The pain tolerance of children did not appear to be related to pain tolerance of mothers. Although a similarly small number of mothers removed their arm from the cold water prior to the end of the 240-second trial (n=4), there did not appear to be a significant relation between mothers' tolerance and children's tolerance. For example, a

small and nonsignificant correlation was observed between the duration of mothers'

immersion and children's immersion (r=0.134, p=0.192). However, the size of this

correlation was likely related to the restricted range of values used to determine the

correlation, as a very large majority of mothers and children had a duration of 240

seconds. To more accurately examine this relation, the odds of having a mother who

removed her arm prior to 240 seconds on a child's tolerance was calculated and found to

be not significant (*Odds Ratio*=4.60, 95% *CI*=0.688 - 30.736). The 2 x 2 table showing

the number and percentage of mothers and children who did and did not remove their arm

prior to 240 seconds is presented in Table 13. This finding suggests that children's ability

to withstand the cold water for the full 240-second period was not related to whether or

not their mothers completed the full 240-second immersion.

Insert Table 13 about here

Children's Pain Ratings

During the course of the cold water immersion, children rated how much their arm

hurt on a numerical rating scale (0 - 10) at 30-second intervals for a total of eight

ratings. To reduce the number of dependant variables, four summary scores, consisting of

mean pain ratings for each minute of the immersion, were derived from these eight self-

report ratings. These summary scores were used in subsequent repeated measures analyses

to examine between group differences in self-reported pain intensity.

Several predictions were made regarding group differences in pain intensity scores.

Based on literature reviewed regarding pain modeling, it was predicted that children

assigned to the Exaggerate Condition would have significantly higher pain ratings and that

children assigned to the Minimize Condition would have significantly lower pain ratings

than those assigned to the Control Condition. The manipulation check described earlier,

reporting the results of a One-Way ANOVA of children's ratings of mothers' pain,

confirmed that the proper experimental conditions were created to test these hypotheses.

That is, children assigned to the Exaggerate Condition perceived their mothers as having

significantly more pain than children in the Control Condition and children assigned to the

Minimize Condition perceived their mothers as having significantly less pain than children

assigned to the control condition. It was also predicted that girls would having higher pain

ratings than boys. It was not expected that the experimental manipulation would have a

differential effect on girls compared to boys and therefore, no significant Group X Child

Gender interaction was predicted.

These hypotheses were examined in a 3 x 2 (Group x Child Gender) Repeated

Measures Analysis of Covariance (ANCOVA) with Child Age as the covariate and the

four summary pain scores serving as the Repeated Measures Factor (i.e., representing

mean child pain ratings for each minute of the cold water immersion). An ANCOVA was

chosen for several reasons. Using ANCOVA for the present experiment would remove the

effects of age from the dependent variable, and allow a more sensitive examination of the

effects of the experimental manipulation on pain ratings. Although the age range of

participants was small (i.e., approximately 4 ½ years between the oldest and youngest

child participant), there is some evidence that self-reported ratings of pain among children decrease with age (e.g., Chambers, 1998). Further, ANCOVA increases the power of an experiment provided that the magnitude of the correlation between the proposed covariate (namely, Child Age) and the dependent variable(s) of interest (self-reported pain ratings) is greater than $r = 0.2$ (Keppel & Zedeck, 1989). The Pearson correlations between Child Age and child pain ratings exceeded this value at Minute 1 and Minute 2 of the experiment ($r=-0.29$ at both times, $p=0.006$) and were in the expected direction. The correlations between child age and child pain ratings were also in the expected direction at Minute 3 and Minute 4, but their magnitude did not exceed $r=0.20$ ($r=-0.16$ and $r=-0.10$, respectively).

The means and standard deviations of the summary pain scores for each minute of the cold water immersion by Experimental Group and Child Gender are presented in Table 14. Results of the ANCOVA revealed a significant effect for the Repeated Measures Factor, suggesting that children's self-reported pain ratings changed significantly across rating times, $F(3, 249)=3.96$, $p=0.009$. A significant interaction was noted with the covariate Child Age and the Repeated Measures Factor.

Insert Table 14 about here

Examination of the within subjects contrasts showed a significant linear effect for the Repeated Measures Factor, demonstrating that across Experimental Groups and Child Gender, children's pain ratings decreased over time, $F(1, 83)=5.01$, $p=0.028$. A marginally

significant linear effect was also noted for the Repeated Measures Factor x Child Age interaction, $F(1, 83)=3.83$, $p=0.054$. This finding suggests that the nature of the relation between Child Age and children's pain ratings changed significantly over time. It is likely that this significant interaction reflects the fact that Child Age was significantly negatively correlated with children's pain ratings at Minute 1 and Minute 2 only, and not at Minute 3 and Minute 4.

No difference was observed in the pain ratings of children for the between groups factors Experimental Group ($F < 1$) or Child Gender ($F < 1$), nor was the Group x Child Gender interaction significant. These results are unexpected in that the experimental manipulation did not appear to have any effect on children's pain ratings, nor did pain ratings differ significantly between boys and girls. As predicted, the effect for the covariate Child Age was statistically significant, $F(1, 83)=6.15$, $p=0.015$, suggesting that children's pain ratings were, in part, related to the age of the child.

Differences between Experimental Group and Child Gender in children's pain ratings were examined at each of the four minutes of the experiment in four separate 3 x 2 (Experimental Group x Child Gender) univariate ANCOVAs with Child Age as the identified covariate. No between group differences were found for either Experimental Group or Child Gender. The covariate was significant at Minute 1 ($F(1, 89)=9.02$, $p=0.003$) and Minute 2 ($F(1, 86)=8.85$, $p=0.004$), but not at Minute 3 ($F(1, 83)=2.53$, $p=0.116$) or Minute 4 ($F(1, 83)=1.17$, $p=0.282$).

Children's Facial Action

During the course of the cold water immersion, children rated how much their arm hurt at 30-second intervals for a maximum of eight pain ratings. The 10-second period just prior to each of these ratings was selected to code the five pain-related facial actions of interest (i.e., Brow Lower, Eye Squeeze, Cheek Raiser, Nose Wrinkler, Upper Lip Raise) using the Child Facial Coding System (CFCS; Chambers, Cassidy, McGrath, Gilbert, & Craig, 1996). This period was selected because it was temporally close to the time of the numerical self-report rating of pain intensity. Further, neither the child's facial behaviour, nor the view of the child's face were disturbed by the process of making a numerical rating during this period. The scores for these five facial actions were summed to form a total score for each of the 10-second periods immediately preceding each pain rating.

To reduce the number of dependent variables, a summary score, consisting of the sum of CFCS ratings for each minute of the immersion were derived from these eight total scores. For example, the summary CFCS score for the first minute of the immersion consisted of the total score for the 10 seconds preceding the pain rating at 30 seconds plus the total score for the 10 seconds preceding the pain rating at 60 seconds. CFCS scores for the other three minutes were derived in the same manner. These summary scores were used in subsequent repeated measures analyses to examine between group differences in observed pain-related facial behaviour.

The hypotheses regarding group differences in CFCS scores were essentially the same as those made for self-report ratings of pain intensity. Based on literature reviewed regarding pain modeling, it was predicted that children assigned to the exaggerate

condition would have significantly higher CFCS scores and that children assigned to the

minimize condition would have significantly lower CFCS scores than those assigned to the

control condition. It was also predicted that girls would having higher CFCS scores than

boys. It was not expected that the experimental manipulation would have a differential

effect on girls compared to boys and therefore, no significant Group x Child Gender

interaction was predicted.

These hypotheses were examined using a 3 x 2 (Group x Child Gender) Repeated

Measures ANCOVA with child age as the covariate and the four summary CFCS scores

serving as the Repeated Measures Factor (i.e., representing child pain behaviour scores for

each minute of the immersion). The ANCOVA procedure was selected again because of

the likelihood that observed pain behaviour decreases with age in children (e.g.,

Chambers, 1998). A significant negative correlation between child age and pain behaviour

was observed at Minute 1 ($r=-0.30$, $p=0.003$), at Minute 2 ($r=-0.40$, $p=0.000$), and at

Minute 3 ($r=-0.22$, $p=0.042$). The Pearson correlation between child age and pain

behaviour at Minute 4 was in the expected direction but did not reach statistical

significance ($r=-0.21$, $p=0.064$).

The means and standard deviations of the summary CFCS scores for each minute

of the immersion by experimental group and child gender are presented in Table 15.

Results of the ANCOVA revealed a significant effect for the Repeated Measures Factor,

suggesting that ratings of children's facial pain behaviour changed significantly across

rating times, $F(3, 228)=7.28$, $p=0.000$. A significant interaction was noted between the

Repeated Measures Factor and Child Age, $F(3, 228) = 5.50$, $p = 001$, as well as between

the Repeated Measures Factor and Experimental Group, $F(6, 228)=2.88, p=0.010$. The

Repeated Measures Factor x Child Gender interaction was marginally significant, $F(3,$

$228) = 2.57$, $p = 0.055$. The remaining Repeated Measures Factor x Experimental Group x

Child Gender interaction was not statistically significant.

Insert Table 15 about here

Examination of the within subjects contrasts showed that several of the linear

effects were statistically significant. Although the linear effect for the Repeated Measures

Factor alone was statistically significant, all of the two-way interactions between the

Repeated Measures Factor and the between subjects factors as well as between the

Repeated Measures Factor and the covariate, Child Age, showed significant linear effects.

The Repeated Measures X Child Age interaction, $F(1, 76)=8.07, p=0.006$,

suggests that the nature of the relation between child age and children's CFCS scores

changed significantly over time. It is likely that this significant interaction reflects the fact

that child age was significantly negatively correlated with children's pain ratings at Minute

1 and Minute 2 only, and Minute 3. Further, the magnitude of the relation appeared to

change over time, with correlations ranging from -0.20 to -0.40.

The Repeated Measures Factor x Experimental Group interaction, $F(2, 76)=3.85$,

$p=0.025$, suggests that the way in which CFCS scores change over the course of the

experiment is significantly different across groups. This interaction is presented in Figure 1

and shows that CFCS scores decrease over the course of the experimental in the

exaggerate and control conditions, but that CFCS scores in the minimize.groups show

relatively little change over the course of the experiment.

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Insert Figure 1 about here

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The Repeated Measures X Child Gender interaction, F (1, 76)=3.83, p=0.054, was

marginally significant and suggests that the pattern of CFCS scores over the duration of

the cold pressor test was different for boys compared to girls. This interaction is presented

in Figure 2 and illustrates that boys' CFCS scores show a sharper decrease over the course

of the experiment, starting higher at Minute 1 and ending lower at Minute 4, compared to

girls' CFCS scores. The CFCS scores of girls show relatively less change over time.

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Insert Figure 2 about here

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Examination of between group differences showed that CFCS scores did not differ

significantly between boys and girls (F < 1), and that the Child Gender X Experimental

Group interaction was not statistically significant, $F(2, 76)$=2.17, p=0.122. As predicted,

the effect for the covariate Child Age was statistically significant, $F(1,76)$=16.04,

p=0.000, suggesting that children's CFCS scores were significantly related to the age of

the child. A significant main effect for Experimental Group, $F(1, 76)$=7.37, p=0.001 was

observed. Planned orthogonal contrasts showed that CFCS scores were significantly higher in the Exaggerate Group compared to the Minimize Group (95 % CI=4.98 - 20.19, p=0.001), but that no significant difference existed between the Exaggerate and Control Groups (95 % CI=-8.03 - 6.93, p=0.884). These findings support the hypothesis that children in the Exaggerate Condition would show more facial pain behaviour compared to those in the Minimize group. The findings that no difference existed between children assigned to the Exaggerate and Control Conditions or between the Minimize and Control condtions were not expected.

Differences between Experimental Group and Child Gender in children's CFCS scores were examined at each of the four minutes of the experiment in four separate 3 x 2 (Experimental Group x Child Gender) univariate ANCOVAs with Child Age as the identified covariate. No between group differences were found for Child Gender. The covariate was significant at Minute 1 (F(1, 87)=11.25, p=0.001), Minute 2 (F(1, 84)=20.29, p=0.000) , and at Minute 3 (F(1, 81)=5.53, p=0.021), but not at Minute 4 (F(1, 76)=2.75, p=0.101). Between group differences were noted for Experimental Group at Minute 1 (F(1, 87)=3.63, p=0.031), Minute 2 (F(1, 84)=3.73, p=0.039) , and at Minute 4 (F(1, 76)=3.06, p=0.052), but not at Minute 3(F(1, 81)=1.18, p = 0.314).

Global Ratings of Children's Pain Behaviour

Three independent, undergraduate students, blind to the nature and purpose of the experiment, rated children's facial activity from videotape using a 10 cm visual analogue scale (VAS). VAS ratings were made every 30 seconds and coincided with children's self-

report ratings of pain intensity. The mean VAS rating for each of the eight rating times

across experimental groups as a function of rater are presented in Table 16. As

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Insert Table 16 about here

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shown in this table, some degree of variability is apparent across raters. Pearson

correlations were computed for each rating time to examine the relation between the VAS

ratings of each rater. These correlations are presented in Table 17. Correlation

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Insert Table 17 about here

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coefficients ranged from $r=$ -0.07 between Rater 1 and Rater 3 at rating time 4 (120

seconds) to $r=$ 0.71 between Rater 1 and Rater 2 at time 1 (30 seconds), which suggests

considerable variability from one rater to the next. To examine the overall reliability of

raters, intraclass correlations were computed for each rating time. The intraclass

correlation is an excellent measure of reliability because it expresses the proportion of the

total variance in raters' measurements (including error) which is due to "true" difference

between ratings (Norman & Streiner, 1994). In this case, "true" represents the average of

the three VAS ratings for each participant in the study. The intraclass correlation also has

an advantage over the Pearson correlation as an index of reliability as it provides an

overall estimation of the reliability of a group of two or more raters (Streiner & Norman,

1995). Further, the Pearson correlation can be inflated by systematic variation in ratings

(i.e., when Rater 1=3.5, Rater 2=7.0; when Rater 1=5, Rater 2=10; when Rater 1=6, Rater 2=12), and as such can overestimate reliability. The intraclass correlations at each of the eight rating times are also presented in Table 19. The intraclass correlations range from ICC=0.090 to ICC=0.31 and demonstrate that only 9% to 31% of the score variance is captured by the three raters, depending on the rating time. As the VAS ratings were unreliable estimates of facial activity, no subsequent analyses were computed using these as dependent variables.

Secondary Analyses

Relation Between Children's Pain Intensity and Children's Facial Activity

The relation between children's pain intensity ratings and children's CFCS scores was examined by computing Pearson correlations between the summary scores derived for each minute of the cold pressor task for each of these measures. Correlations were also computed to show the relation between both self-report ratings and CFCS scores at different times during the immersion. These correlations are presented in Table 18.

Significant positive correlations were noted between children's ratings of pain intensity and CFCS scores at Minute 1 (r=0.52, p=0.000), Minute 2 (r=0.49, p=0.000), and Minute 3 (r=0.23, p=0.029) of the cold pressor task. The correlation between pain intensity and CFCS scores at Minute 4 was not significant (r=0.15, p=0.175). Significant positive correlations were also noted for both self-report ratings and CFCS scores across rating times.

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Insert Table 18 about here

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Relations Between Secondary Covariates, Pain Intensity, and CFCS Scores

Prior to the completion of secondary data analyses evaluating the relations between secondary covariates and pain scores, One-Way Analysis of Variance (ANOVA) was used to examine potential differences in secondary covariates between experimental groups. No between group differences were found for any of the measures which included the Illness Behavior Encouragement Scale - Parent Report (F (2, 95)=1.38, p=0.258), the Illness Behavior Encouragement Scale - Child Report (F (2, 95)=0.15, p=0.864), the Pain Catastrophizing Scale (F (2, 95)=0.15, p=0.857), the State Form of the State-Trait Anxiety Inventory for Children (F (2, 94)=1.11, p=0.334), and the Trait Form of the State-Trait Anxiety Inventory for Children (F (2, 94)=0.418, p=0.660).

The relations between secondary covariates, children's pain intensity ratings, and children's CFCS scores were examined by computing Pearson correlations between the summary scores derived for each minute of the cold pressor task for each of these measures. These correlations are presented in Table 19. Because of the number of correlations computed, a more stringent alpha level of p = 0.01 was used to determine statistical significance. None of the secondary covariates was significantly correlated with either pain intensity ratings or CFCS scores at any point of the cold pressor task.

Insert Table 19 about here

CHAPTER 8. STUDY 2: DISCUSSION

Overview

The findings of this study lend partial support to the proposed hypotheses. Each hypothesis will be examined, the findings which support or refute each hypothesis will be reviewed, and possible explanations will be given to clarify the meaning of each finding. It is likely that the dearth of literature regarding how children respond during a cold pressor task made it difficult to make accurate predictions about possible outcomes in the present study. However, the data show a reasonably clear relation between children's and mothers' pain-related behaviour and pain reporting.

Review of Primary Analyses and Discussion

Children's Pain Threshold

The hypothesis that children assigned to the Exaggerate condition would have significantly lower pain thresholds compared to those assigned to the Minimize and Control conditions was fully supported. The pattern of children's self-reported pain threshold by experimental group was the same as that observed for mothers' threshold. This finding shows that mothers in the Exaggerate condition had a significant impact on their child's threshold during the experiment.

In the present study, threshold was defined for participants as the point at which painful sensations were perceived in the immersed forearm. Self-reported pain threshold was determined by asking participants to raise the non-immersed hand the moment any painful sensations were perceived. The moderately cold temperature of the water used in

this study as a pain stimulus was not uniformly painful for all participants, according to their self-report of intensity. For example, four children reported that the stimulus did not produce pain in their arm, and examination of these children's pain ratings supports the validity of their claims.

The fact that several children (12 out of 96) reported that they forgot to indicate threshold raises concern that children had a poor understanding of the concept of threshold, or that the manner in which threshold was measured has less than adequate reliability. However, there are several factors which support the notion that these 12 children likely forgot to indicate threshold, rather than it being related to an experimental confound.

Firstly, to enhance the standardization of the experiment, all instructions were audiotaped. The audiotaped instructions allowed the children to concentrate on the pain sensations of the cold pressor test by eliminating the need for them to remember and carry out a new and complex set of experimental instructions. In essence, the children simply had to follow instructions and did not have to think about what to do next. The instructions also reduced the need for prompting and interference by the experimenter. However, the audiotaped instructions included only one description and one reminder about when and how to indicate threshold. Repeated reminders about threshold were not included for fear of biasing children's report of threshold. The examiner, instead, chose to post a large sign on the wall indicating when and how to indicate threshold. The lack of multiple reminders to indicate threshold may have been related to children's forgetting.

Secondly, there was no difference in the proportion of children who did and did

not indicate threshold by experimental group, child gender, or child age. These findings show that forgetting to indicate threshold was not related to the nature of the experimental manipulation or to other independent variables of interest. These findings also show that children who forgot to indicate threshold were randomly distributed among the experiment's independent variables, and may represent, yet another individual difference factor that plays into measurement of pain qualities.

Thirdly, it was quite clear that children understood the nature of the instructions about when and how to indicate threshold. As part of the instructions, the examiner asked the children "When your arm first starts to hurt, what are you supposed to do?", and all children provided the correct response (i.e., to raise the non-immersed hand when they first perceived pain). As further instruction, children observed their mothers indicating threshold in the same manner less than 10 minutes prior to their cold pressor task. However, children were experimentally naive to the cold pressor task. Their lack of experience with this type of pain may have made the judgement of pain threshold more difficult or less obvious. The children may also have anticipated that the onset of pain would be relatively acute. For some children, the cold water produced a more gradual onset of pain, as shown by their ratings of pain intensity, and this potential discrepancy between what may have been anticipated and what occurred may have made the decision to indicate threshold less obvious and therefore more difficult to make. Further, indication of threshold was made on only one occasion and no opportunity to practice was given. This factor may have also contributed to children forgetting to indicate threshold.

No other research study has examined the relation between mother's and child's

threshold using the cold pressor test to induce pain. Only one other study has examined

self-reported pain threshold in a cold pressor task with children using similar water

temperature (Miller, Barr, & Young, 1994). Although the task of indicating threshold

appears to be a relatively simple behaviour, this study shows that underlying this behaviour

is a potentially complex set of decisions which can be influenced by others behaviour.

Because these decisions are private, by nature, they are that much more difficult to study

in an experimental situation and there is a risk of altering them by investigation in the form

of experimental manipulation or survey.

Children's Pain Tolerance

Specific predictions regarding the effect of the experimental manipulation on pain

tolerance were difficult to make, given the relatively few studies which have examined

children's pain tolerance in a cold pressor test. It was unexpected that only six children of

the sample of 96 removed their arm prior to the maximum duration of 240 seconds.

Reaching or not reaching the point of pain tolerance was not significantly related to

experimental group, child gender, or child age. The relatively small number of children

who removed their arm prior to 240 seconds made formal statistical analyses of pain

intensity ratings and child facial action scores between these groups of children not

possible. Having a mother who completed less than 240 seconds of the immersion did not

increase the risk of her child completing less than 240 seconds of the immersion. As such,

mothers' tolerance did not appear to be related to children's tolerance.

Based on the research of Fanurik, Zeltzer, Roberts and Blount (1993), more

variation in children's tolerance of the pain from the cold pressor task was expected. The mean tolerance for children in the Fanurik et al. study ranged from approximately 20 to 77 seconds, despite the use of psychological interventions to reduce pain. However, the participants of this study were somewhat younger (8 - 10 years) than those who participated in the present study (10 - 14 years). Similarly, Miller, Barr, and Young (1994) reported that only 57% of children aged 8 to 11 years tolerated a full four minutes of a cold pressor task with a water temperature of 10 °C. It is possible that the older age of participants in the present study was related to the relatively higher tolerance noted.

Children in the Fanurik et al. study were also instructed to keep their arm in the water as long as possible, but were not informed of the maximum possible length of the trial (240 seconds). The children in the present study were informed of the maximum duration of the cold pressor task which may have provided them with the expectation to complete the entire trial. Mothers in the present study were also informed of the length of the experimental trial and a similarly small proportion of mothers (4 out of 96) removed their arm from the water prior to completion of the complete 240 seconds. Although there was no statistically significant relation between mothers who removed their arms early and children who removed their arms early, the majority of children observed their mothers completing a complete experimental trial. It is possible that the combined effect of the expectancy associated with being informed of the maximum duration of the task and observing their mothers complete a full trial could explain the finding that the majority of children did not reach the point of pain tolerance in the present study.

However, it is unlikely that the majority of children tolerated the complete

immersion only because of perceived expectancy to do so. The fact that the majority of children did not reach the point of pain tolerance can also be explained, in part, by examination of children's self-report pain ratings. Pain ratings appeared to reach their maximum at the end of the second minute of the immersion, and gradually declined thereafter. The highest mean pain rating at the end of Minute 2 was only 5.3 on the numerical scale (0 - 10), which suggests that the experience, at its worst, was only moderately painful.

The absence of a pump to circulate the water during the cold pressor task also may have been related to the observed decrease in children's pain intensity ratings over time and to the fact that the large majority of participating children (and mothers) tolerated the full immersion. Pumps are often used to circulate the water during a cold water immersion to prevent warming of the water around the hand and forearm (Hilgard et al., 1974; Harris & Rollman, 1983). The warming of the water immediately around the hand can serve as a buffer against the colder surrounding water. The decision to omit the use of a pump was made based on several factors which were appraised as threats to the integrity of the experiment. The first three adult volunteers who were asked to serve as models for the instruction video for mothers expressed concern about the use of the submersible electric pump while their arm was immersed, even though the pump was equipped with a ground-fault indicator to prevent shock. Another factor which contributed to the decision to not use a pump was related to previous experience with external pumps used to circulate the water. For example, in another study from our laboratory which used a cold pressor paradigm (e.g., Braha, Goodman, & McGrath, 1993), the participants often made

comments during the experiment about the noise of the pump, or about the fact that the pump was leaking, or asked questions about why the pump was being used. The potential for the pump distracting participants during the experiment also contributed to the decision to not use a pump. Although participants likely experienced warming around the hand and arm, because the experience was consistent across groups, the fact that a pump was not used was not viewed as a major threat to the validity of the experiment.

Pain tolerance in children in the context of experimentally induced pain is an area that has only begun to be examined. Very little research has attempted to study the developmental, physiological, and psychological factors which are related to pain tolerance in children. A better understanding of the factors which either lengthen or shorten children's pain tolerance with experimental pain stimuli may have useful clinical application. For example, the relevance of these factors to understanding other types of non-experimental pain (i.e., clinical pain such as pain from needles, chronic or recurrent pain, or everyday pain) has not yet been investigated and may shed light on behaviours such as decisions to request medication for pain, or on the relation between pain intensity and pain-related disability. Examination of these factors using experimental designs may allow for a more efficient way to gather preliminary information about children's pain tolerance because of the advantages associated with experimental designs (e.g., random assignment, better standardization and control of variables, etc.) and uniformity and control of the pain stimulus.

Children's Pain Ratings

The hypothesis that children assigned to the Exaggerate condition would have significantly higher pain ratings compared to those assigned to the Minimize and Control conditions was not supported. Although the means were generally in the expected direction, the difference in mean pain intensity at each rating time across experimental groups was not statistically significant. Similarly, no difference was noted in pain ratings between boys and girls. This finding shows that the experimental manipulation did not have a statistically significant impact on the children's self-reported pain ratings.

There are several possible and theoretically viable explanations for this, what seems to be, "null" finding. Firstly, both children and mothers were explicitly instructed to keep their pain ratings private and not to share them with each other until after the entire experiment was completed. The purpose of this instruction was to prevent participating children from gaining access to their mothers' ratings to avoid the situation where the ratings could be potentially discrepant with the mothers' observed facial behaviour. Such a situation would render the manipulation of exaggerated or minimized facial behaviour less meaningful and possibly confusing to the observing children. As such, children were not given access to the pain ratings of their mothers and thus, could not model from them directly. Children could only infer what their mothers' pain ratings were from their behaviour. Indeed, the manipulation check asking children to estimate mothers' pain intensity confirmed that children in the Exaggerate condition rated their mothers' as having more intense pain compared to mothers in the Minimize condition. The children's estimates were based on information gleaned from observing the mothers' behaviour, as

they did not have access to the intensity ratings. This manipulation check also directed the children to deliberately think about what the experience was like for their mother, and perhaps facilitated the modeling process by making the information about their mothers' experience more explicit to the children.

Past research has shown that self-report ratings of pain intensity during a cold pressor task (1 °C) generally conform to a model's, whether the model's ratings under-report or over-report the degree of pain intensity experienced (Craig & Patrick, 1985; Patrick, Craig, & Prkachin, 1986). In these studies, the participants had access to the self-report ratings of the model. This information could have been used as a direct and obvious reference point to which they could compare their own experience and adjust their reports. In the present study, children were not provided with direct and obvious information about mothers' pain ratings. The only information available to children was the mothers' observable facial behaviour.

The hypothesis that girls would report higher pain ratings than boys was also not supported. Mean ratings of pain intensity for girls were in the expected direction for the Minimize condition (i.e., higher than boys) but were noted to be in the opposite direction to that expected for the Exaggerate and Minimize conditions (i.e., lower than boys). These differences were not statistically significant.

LeBaron, Zeltzer, & Fanurik (1989) reported that girls tended to have higher ratings of pain intensity during cold pressor tasks with water temperatures of 12 °C and 15 °C, although formal statistical analyses were not reported. Zeltzer, Fanurik, & LeBaron (1989) also noted higher pain ratings for girls compared to boys, but this finding was

observed only at the rating made 10 seconds following immersion, during the trial with 15 °C water. Girls were also noted to have higher ratings than boys at 40 seconds following immersion with 12 °C water, but only during the baseline condition. Miller, Barr & Young (1994) were not able to accurately comment on the effect of gender because the girls in this study were significantly younger than boys, and age was also related to reports of higher pain intensity. Given that these studies used slightly different methodologies and, two of the three were examining the effects of an intervention to reduce pain, it is difficult to draw firm conclusions regarding differences in pain intensity attributable to gender. In light of the present study's finding of no difference between boys' and girls' ratings of pain intensity, it seems reasonable to tentatively conclude that an overwhelming or consistent difference between boys and girls in self-reported pain intensity during cold pressor tasks does not exist.

A significant negative correlation was noted between child age and ratings of pain intensity at Minute 1 and Minute 2 of the immersion ($r = -0.29$, $p = 0.006$). This finding provides some support for the hypothesis that younger children would report higher levels of pain intensity compared to older children. Examination of age-related findings in studies using a cold pressor task do not show a uniform pattern of younger children reporting significantly higher levels of pain intensity (e.g., Zeltzer, Fanurik, & LeBaron, 1989). Results from the few studies which have examined age-related differences in self-report of pain from cold water immersion do not provide a clear enough picture to make definitive conclusions. However, the findings of the present study are generally consistent with the age-related findings reported for pain from needle procedures (e.g., Goodenough,

et al., 1997; Bournaki, 1997; Arts et al., 1994) which have consistently shown that younger children report higher ratings of pain compared to older children.

Children's Facial Action

The hypothesis that children assigned to the Exaggerate condition would show significantly more pain behaviour and that children assigned to the Minimize condition would show significantly less pain behaviour compared to those assigned to the Control condition as measured by the Child Facial Coding System (CFCS; Chambers et al., 1996) was partially supported. Children assigned to the Minimize condition showed significantly less pain behaviour than children assigned to the Control condition. However, no difference was noted between children assigned to the Exaggerate and Control conditions. Further examination of CFCS scores over the duration of the experiment showed that CFCS scores for children in the Exaggerate and Control conditions showed a relatively sharp decrease over the experiment, while CFCS scores of children in the Minimize condition remained relatively unchanged.

It was not expected that the Exaggerate and Control conditions would show similar amounts of pain-related facial behaviour. Although children in the Control condition rated their mothers as having significantly less pain than did children in the Exaggerate Condition, there was no difference in observed behaviour between the two groups. Examination of the mean CFCS scores for these two groups shows very little difference in the amount of facial activity displayed over the course of the experiment. Indeed, children from these two groups show a near identical pattern of CFCS scores over time.

This null finding may be related to the limited strength of the experimental manipulation. Although the manipulation check showed that there was a statistically significant difference between groups in children's overall ratings of mothers' pain, the difference between the mean rating of the Exaggerate Condition and the mean rating of the Minimize condition was only three points on the 0 - 10 numerical rating scale, and the difference between the mean rating of the Exaggerate Condition and the Control condition was only two points. This relatively small difference may not have been large enough to be observed as differences in pain behaviour as measured by the CFCS. The CFCS may not be sufficiently sensitive to capture this difference.

Indeed, the Child Facial Coding System is a relatively new tool which was developed only a few years ago as a measure of facial activity related to pain with acute onset (Chambers et al., 1996). With proper training and supervised practice, facial actions can be coded with excellent reliability. Although there is preliminary evidence to suggest that higher CFCS scores are related to more intense pain (e.g., Gilbert et al., 1998), the facial actions coded with this system are not specific to pain. For example, the facial action "Upper Lip Raise" is coded at an intensity level of 1 if the "centre of the upper lip is raised slightly causing an angular bend in the shape of the upper lip with slight pouching or bulging of the inner corner of the infraorbital triangle..." and "...less than one half of the upper teeth visible" (Chambers et al., 1996). Intensity level 2 for this facial action is assigned when "...the centre of the upper lip is raised distinctly to maximally, causing an angular bend in the shape of the upper lip with distinct pouching or bulging of the infraorbital triangle..." and "upper teeth are mostly visible to completely visible."

(Chambers et al., 1996). However, it is possible that this facial action can occur and be coded in the context of a smile or a grimace, regardless of whether a child is experiencing pain at that moment. The same is generally true for the other four facial actions used in the present study.

However, few alternate measures of pain behaviour exist. For example, the poor reliability of the VAS ratings of pain-related facial activity showed that it was not possible to accurately code facial activity along a global dimension of "no pain" versus "worst pain imaginable" for this type of pain stimulus. Although a VAS or other global type of rating system may be acceptable for measuring pain that is shorter lasting (e.g., pain from electric shock; Prkachin & Craig, 1985; pain from immunization; Schechter, Bernstein, Beck, Hart, & Scherzer, 1991), results of the present study showed that it was exceptionally difficult for coders to rate facial activity along a global dimension when changes over time were likely more subtle. Even at the point of the first rating, when facial activity was generally at its peak, the reliability of the VAS coders was disastrously low. It is likely that changes in facial activity were far too subtle to be accurately captured by a simple VAS rating.

There is some evidence in research with adults that clusters of facial actions which occur simultaneously are observed uniquely in situations involving intense, acute pain (e.g., LeResche, 1982). This research might suggest that the best way to capture facial activity specifically related to pain is to code facial actions only when they are seen at the same moment. However, evidence also exists that suggests that individual facial actions, which do not necessarily co-occur in time, are related to both the sensory and affective

properties of pain (Prkachin & Mercer, 1985) and that some show a consistent association with pain intensity and pain duration across different types of pain (e.g., pain from electric shock, cold, pressure, or ischemia; Prkachin, 1992). This body of literature provides empirical support that a fine grained analysis of facial activity is an accurate way to capture and analyze changes in facial activity related to pain. Systems that incorporate a fine-grained analysis, such as the CFCS, are able to code subtle changes in facial activity that may be associated with relatively small changes in pain that can not be accurately captured by global ratings. This poor reliability observed in the present study for the VAS ratings of pain likely reflects how difficult it is for an observer to capture changes in facial activity without a standardized procedure grounded in theory.

It is possible that some of the facial activity observed and coded in the present study may be related to other emotional states associated with pain or related to emotions associated with the novelty and peculiar nature of the task itself (e.g., anxiety or amusement). The finding of a similar pattern of facial activity between children in the Exaggerate and Control groups may be related to similarities in the amount of facial activity shown by mothers in the respective groups, even though mothers in the Exaggerate condition were rated as having more pain than mothers in the Control condition. This finding is that much more plausible when considering the data of the Minimize Group. Mothers who were assigned to the Minimize group were instructed to minimize their facial expressions during the cold water immersion. The models depicted in the training video shown to this group of mothers depicted women with neutral expressions who showed very little expression on their face. It is not surprising that

children assigned to the Minimize condition also showed very little facial activity.

The utility of the CFCS for the study of pain in children is that it provides a fine-grained analysis of subtle changes in facial activity, and that these subtle changes can be related to changes in pain intensity. It would be exceptionally difficult, if not theoretically impossible, to identify facial behaviours which are specific and unique to the expression of pain. One obvious reason is that all facial actions can be mimicked in the absence of pain. However, the CFCS has potential to contribute valuable information to supplement self-report ratings of pain intensity when global ratings of pain are not appropriate (i.e., when the pain is longer lasting or less intense).

No difference was noted in CFCS scores for boys and girls, but the change in CFCS scores across rating times differed significantly between boys and girls. Specifically, boys' CFCS scores over the first and second minutes of the immersion were higher than the girls', but lower than girls' over the final minute of the immersion. This finding shows that boys' display of facial behaviour was somewhat more variable over the course of the experiment compared to girls. This difference in pattern over time was not anticipated, and suggests that the relation between child gender and observed pain behaviour is perhaps more complex than anticipated. No research has examined gender differences in observed pain behaviour during a cold pressor task with children. Indeed, research has suggested that there is likely more variability in response to experimental pain paradigms within males or females (among adults) than there is between the two groups (Edens & Gil, 1995) and drawing simple conclusions about group differences may obscure the true relation, especially in light of other factors which may alter pain expression, such as

interventions for reducing pain or the relationship of the child participant to others who may be present. In a study of children aged 7 to 11 years old, children reported that they were less likely to control their expression of pain in the presence of a parent compared to the presence of a peer (Zeeman & Garber, 1996). Further, this study also showed that boys were more likely than girls to report regulating their display of pain and noted that girls anticipated others to show more understanding and acceptance about emotional displays than boys. The study of gender differences in pain-related facial activity in children is an area of study which is deserving of further attention, as it may provide useful information for better understanding the operant factors which may be related to differential reinforcement of pain and illness behaviour between boys and girls.

General Discussion

The present research attempted to examine some of the variables which explain how children learn about pain in the context of their families. The first study provided epidemiological evidence to show that pain complaints tend to co-occur within families in the general population. This study examined risk of co-occurrence for different pain phenomena (i.e., pain incidents, clinically severe pain incidents, and disabling pain incidents) and identified specific variables which increased the risk of experiencing a specific pain phenomenon. Overall, females (both children and adults) were observed to be at increased risk for reporting pain, across type and severity of pain. Increasing child age was associated with increased risk for having clinically severe pain and disabling pain incidents. Exposure to a parent with pain was associated with increased risk of a child

reporting pain.

These findings demonstrated that children who are exposed to pain by a parent are more likely to also report pain. This study is the first to document, prospectively, that children who report pain tend to be exposed to parents who also report pain. These data are perhaps more compelling in that the focus was on all types of pain, including everyday pain incidents (e.g., ear ache, sore throat, headache, pain from minor injury) as well as pain from clinically diagnosed conditions (e.g., migraine). Given the diversity of pain incidents that were reported by respondents, it is very unlikely that the observed co-occurrence can be explained by a single factor such as genetic influence or constitutional similarity. The identification of a pain incident and recording of pain characteristics are learned behaviours, and the acquisition and display of these behaviours can be altered by social learning factors such as modeling. This study provides evidence that the outcome of modeling of pain exists in the general population.

A primary limitation of the first study is that it is correlational, and the directionality of the relations can not be determined. It would seem plausible to assume that exposure to pain in a parent *causes* the child to be at greater risk for reporting pain or pain-related disability. However, there are many variables which may be responsible for the association between parents' pain and children's pain which were not measured in the present study. For example, the increased associated between parents and children with pain may have been caused by a harmful environmental agent (paint fumes, a virus affecting all family members) or shared genetic predisposition (weak patella tendons). To provide more compelling evidence that parental pain is directly related to children's pain,

future research should identify specific risk factors in parents and follow children who are and are not exposed to such risk factors longitudinally to determine whether the risk factor(s) increases or decreases the likelihood of having pain. It is also likely that more definitive evidence could be obtained if specific pain conditions (e.g., migraine headache, recurrent abdominal pain) are examined. Examination of more specific pain conditions may allow the identification of more specific risk factors.

The second study sought to determine whether similarities between mothers and children in the reporting of pain characteristics could be systematically manipulated during an experimental pain paradigm. Specifically, this study examined whether children's pain threshold, ratings of pain intensity, and observed pain-related facial behaviour would conform to that of their mother's during a cold pressor task. Results showed that children reported a lower pain threshold after observing mothers who were instructed to exaggerate their report of pain threshold (i.e., by reporting threshold earlier than other groups). Results also showed that children's facial behaviour conformed to that of mothers who minimized their display of pain-related facial behaviour during the cold pressor task. Children's ratings of pain intensity during the cold pressor task did not conform to their mothers', although means were generally in the expected directions. These results suggest that, even in a very artificial and novel situation, children's pain-related behaviour (i.e., ratings of pain threshold and observed facial behaviour) generally conformed to their mothers' behaviour.

When compared to the findings of Study 1, a similar pattern can be identified in Study 2. The outcome of modeling was observed in both studies. Despite using a very

different methodology and addressing different research questions, Study 2 showed that when the proper conditions for modeling of a behaviour are created, the likelihood of the behaviour occurring is increased.

These broad conclusions are offered in an attempt to simplify a very complex set of behaviours and to summarize an enormous amount of data. Pain is a complex phenomenon because its expression is determined by both biological factors, which are still not yet well understood, and by an immeasurable number of social learning factors. Study 2 attempted to manipulate and control only a few of the social learning factors which are likely related to pain expression. Much more study is necessary before researchers can accurately understand the variables which predict pain expression among children and adolescents. Study 2 only examined the impact of a mother's behaviour on her child during a cold pressor task. An important next step would be to include fathers in a similar experiment to determine whether a father's behaviour has a similar impact on children.

Another important clinical application of this type of methodology would be to use a similar cold pressor paradigm to examine the social learning factors related to the development and maintenance of a chronic or recurrent pain condition during childhood to determine whether parental modeling plays a role.

Another limitation of the present research is that it did not take into account the operant factors which may have played a role in shaping children's behaviour during the cold pressor task. To create a laboratory situation that is closer to a child's true experience, it may be useful to include measures of operant factors such as parental reinforcement of reporting higher or lower pain intensity or reinforcement of reporting

higher or lower pain threshold. The multitude of possibilities clearly shows that this type

of methodology has enormous potential for helping researchers better understand the

factors that are related to the development of pain expression in children and adolescents.

Table 1

Distribution and Prevalence of Pain Incidents by Location and Family Category

Family Category	No Pain N (%)	Head Pain N (%)	Chest Pain N (%)	Back Pain N (%)	Abdominal Pain N (%)	Arm Pain N (%)	Leg Pain N (%)
Mother (n = 663)	121 (18.3%)	336 (50.7%) 681 reports	42 (6.3%) 88 reports	202 (30.5%) 495 reports	142 (21.4%) 243 reports	118 (17.8%) 381 reports	205 (30.9%) 626 reports
Father (n = 484)	146 (30.2%)	157 (32.1%) 321 reports	23 (4.8%) 61 reports	127 (26.2%) 361 reports	36 (7.4%) 63 reports	104 (21.5%) 271 reports	144 (29.8%) 437 reports
Daughter (n = 553)	101 (18.3%)	266 (42.9%) 515 reports	30 (5.4%) 47 reports	108 (19.5%) 180 reports	162 (29.3%) 238 reports	120 (21.7%) 198 reports	253 (45.8%) 544 reports
Son (n = 542)	121 (22.3%)	196 (39.9%) 302 reports	43 (7.9%) 67 reports	73 (13.5%) 125 reports	70 (12.9%) 99 reports	122 (22.5%) 206 reports	254 (46.9%) 516 reports

Table 2

Distribution of Pain Incidents by Family Category among Mothers, Fathers, and First

Participating Child

Family Category	Total Number of Incidents	Mean Number of Incidents	SD	Range
Mother n=663	2513	3.8	4.8	0 - 36
Father n=484	1514	3.2	4.9	0 - 51
Daughter n=400	1336	3.3	3.4	0 - 24
Son n=293	665	2.3	2.4	0 - 21

Table 3

Proportion of Children Reporting Large (> 4) Total Number of Pain Incidents With Mother's Pain as Risk Factor

Variables in Regression Equation			*RR* (95% *CI*)	*p*
Gender of Child				
Female	26.5% (103/388)		0.59 (0.46 - 0.75)	0.031
Male	17.8% (49/275)			
Age of Child			1.03 (1.00 - 1.07)	0.267
Age of Mother			1.00 (0.98 - 1.02)	0.861
Mother with Large Total Number of Pain Incidents (>3rd quartile)				
Mother with	30.9% (50/162)		2.06 (1.46 - 2.92)	0.037
Mother without	20.3% (102/501)			
Mother with Pain x Gender Interaction				
	Female	Male		
Mother with	34.0% (33/97)	26.4% (17/65)	0.81 (0.53 - 1.26)	0.637
Mother Without	24.1% (70/291)	15.2% (32/210)		

Table 4

Proportion of Children Reporting Large (> 4) Total Number of Pain Incidents With
Father's Pain as Risk Factor

Variables in Regression Equation			RR (95% CI)	p
Gender of Child				
Female	26.9% (77/286)		0.50 (0.39 - 0.66)	0.009
Male	14.2% (28/197)			
Age of Child			1.05 (1.00 - 1.09)	0.170
Age of Father			1.01 (0.99 - 1.03)	0.649
Father with Large Total Number of Pain Incidents (> 3rd Quartile)				
Father with	32.8% (38/116)		1.96 (1.46 - 2.64)	0.023
Father without	18.3% (67/367)			
Father with Pain x Gender Interaction				
	Female	Male		
Father with	37.7% (29/77)	23.1% (9/39)	1.28 (0.80 - 2.05)	0.603
Father Without	23.0% (48/209)	12.0% (19/158)		

Table 5

Distribution of Clinically Severe Pain Incidents by Family Category

Family Category	N	M	SD	Range
Mother n=663	1258	2	4.2	0 - 36
Father n=484	479	1.1	2.9	0 - 28
Daughter n=400	470	1.2	2.6	0 - 24
Son n=293	159	0.6	1.4	0 - 12

Table 6

Proportion of Children Reporting Large (> 1) Number of Clinically Severe Pain Incidents
With Mothers' Pain as Risk Factor

Mothers' Variables in Regression Equation			RR (95% CI)	p
Gender of Child				
Female	23.4% (85/364)		0.36 (0.27 - 0.48)	0.001
Male	13.0% (34/261)			
Age of Child			1.15 (1.11 - 1.19)	0.001
Age of Mother			0.97 (0.95 - 1.00)	0.196
Mother with Large Number of Clinically Severe Pain Incidents (>3rd Quartile)				
Mother with	27.5% (38/138)		3.42 (2.28 - 5.13)	0.003
Mother without	16.6% (81/487)			
Mother with Pain x Gender Interaction				
	Female	Male		
Mother with	27.1% (23/85)	28.3% (15/53)	0.34 (0.21 - 0.56)	0.032
Mother Without	22.2% (62/279)	9.1% (19/208)		

Table 7

Proportion of Children Reporting Large (> 1) Number of Clinically Severe Pain Incidents With Fathers' Pain as Risk Factor

Fathers' Variables in Regression Equation			_RR (95% CI)_	_p_
Gender of Child				
Female	21.3% (57/268)		0.46 (0.32 - 0.65)	0.025
Male	11.0% (20/182)			
Age of Child			1.16 (1.11 - 1.21)	0.001.
Age of Father			0.98 (0.95 - 1.00)	0.381
Father with Large Number of Clinically Severe Pain Incidents (>3rd Quartile)				
Father with	28.2% (22/78)		3.65 (2.08 - 6.43)	0.022
Father without	14.8% (55/372)			
Father with Pain x Gender Interaction				
	Female	Male		
Father with	32.0% (16/50)	21.4% (6/28)	0.66 (0.34 - 1.31)	0.547
Father Without	18.8% (41/218)	9.1% (14/154)		

Table 8

<u>Proportion of Children Reporting Disabling Pain Incidents With Mothers' Pain as Risk
Factor</u>

Mothers' Variables in Regression Equation			*RR (95% CI)*	*p*
Gender of Child				
Female	18.3% (52/284)			
Male	14.5% (31/214)		0.79 (0.61 - 1.02)	0.357
Age of Child			1.07 (1.00 - 1.11)	0.106
Age of Mother			1.01 (0.98 - 1.03)	0.806
Mother with Disabling Pain Incidents (>3rd Quartile)				
Mother with	31.1% (19/61)			
Mother without	14.6% (64/437)		2.29 (1.61 - 3.62)	0.034
Mother with Pain x Gender Interaction				
	Female	Male		
Mother with	30.8% (12/39)	31.8% (7/22)	1.19 (0.84 - 1.98)	0.516
Mother Without	16.32% (40/245)	12.5% (24/192)		

Table 9

<u>Proportion of Children Reporting Disabling Pain Incidents With Fathers' Pain as Risk</u>
<u>Factor</u>

Fathers' Variables in Regression Equation		*RR (95% CI)*	*p*
Gender of Child			
Female	16.9% (35/207)		
Male	14.8% (23/155)	0.92 (0.68 - 1.25)	0.793
Age of Child		1.11 (1.06 - 1.16)	0.023
Age of Father		0.97 (0.94 - 1.00)	0.967
Father with Disabling Pain Incidents (>3rd Quartile)			
Father with	27.0% (10/37)		
Father without	14.8% (48/325)	1.98 (1.42 - 3.12)	0.033
Father with Pain x Gender Interaction			

	Female	Male		
Father with	28.6.% (6/21)	25.0% (4/16)	0.73 (0.41 - 1.28)	0.422
Father Without	15.6% (29/186)	13.7% (19/139)		

Table 10

CFCS Facial Actions Used in the Present Study Corresponding to Those Identified in

Prkachin (1992) with Ekman & Friesen Action Units

CFCS Facial Action (Action Unit)	Prkachin (1992) Facial Action (Action Unit)
Brow Lower (AU 4)	Brow Lower (AU 4)
Eye Squeeze (AU 43/ AU 44)	Eye Closure (AU 43)
Cheek Raiser (AU 6)	Orbit Tightening (AU 6/AU 7)
Nose Wrinkler (AU 9)	Levator Contraction (AU 9/AU 10)
Upper Lip Raise (AU 10)	

Table 11

Mean Child Ratings of Mothers' Pain During Cold Pressor Task by Experimental Group

Group	N[a]	Mean Rating	SD
Exaggerate[a]	30	7.4	1.7
Minimize[b]	30	4.4	1.4
Control[ab]	30	5.4	1.9

*Note: This rating was unavailable for the first six participants.

[a] $p = 0.000$
[b] $p = 0.023$

Table 12

Mean Ratings of Mothers' Pain During Cold Pressor Task by Experimental Group

Group	Minute 1 M (SD)	Minute 2 M (SD)	Minute 3 M (SD)	Minute 4 M (SD)
Exaggerate	4.3 (2.2)	5.1 (2.3)	5.0 (2.3)	4.3 (2.5)
Minimize	3.8 (2.2)	4.9 (2.0)	4.9 (2.0)	4.2 (2.2)
Control	3.8 (2.5)	5.0 (2.2)	4.5 (2.3)	4.0 (2.3)

Table 13

Number and Percentage of Mothers and Children who Did and Did Not Reach Point
of Pain Tolerance Prior to 240 seconds

	Child Tolerance < 240 seconds	Child Tolerance > 240 seconds
Mother Tolerance < 240 seconds	1 (25%)	3 (75%)
Mother Tolerance > 240 seconds	5 (5.4%)	87 (94.6%)

$\chi^2 = 2.504, p=0.114$

$OR = 4.600; 95\% \ CI = 0.688 - 30.736$

Table 14

Means and Standard Deviations of Children's Pain Ratings by Experimental Group and Child Gender

Group		Minute 1 M (SD)	Minute 2 M (SD)	Minute 3 M (SD)	Minute 4 M (SD)
Exaggerate	male	5.1 (2.7)	5.3 (2.3)	4.6 (2.1)	3.6 (2.1)
	female	4.7 (2.7)	4.7 (2.5)	4.0 (2.2)	3.2 (2.2)
Minimize	male	3.4 (2.5)	3.7 (1.8)	3.6 (2.5)	3.1 (2.7)
	female	4.2 (2.3)	4.8 (2.5)	4.2 (2.3)	4.1 (2.3)
Control	male	5.0 (2.6)	5.2 (2.2)	5.0 (2.1)	3.8 (2.2)
	female	3.5 (2.0)	4.0 (1.8)	4.0 (1.9)	3.1 (1.8)

Table 15

Means and Standard Deviations of Child Facial Coding Scores by Experimental Group and Child Gender

Group		Minute 1 M (SD)	Minute 2 M (SD)	Minute 3 M (SD)	Minute 4 M (SD)
Exaggerate	male	42.6 (36.1)	24.8 (19.9)	17.9 (16.7)	9.9 (11.6)
	female	29.7 (20.1)	12.9 (16.1)	10.0 (13.5)	15.3 (16.6)
Minimize	male	7.2 (11.6)	4.3 (10.1)	4.8 (9.2)	3.6 (6.4)
	female	16.2 (17.5)	6.5 (13.9)	11.0 (17.1)	6.2 (10.1)
Control	male	40.0 (36.1)	27.2 (29.6)	13.9 (14.2)	13.4 (14.6)
	female	28.3 (24.3)	19.2 (22.0)	16.9 (18.8)	15.0 (21.0)

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Table 16

Means and Standard Deviations of VAS Ratings of Observed Pain-Related Facial Activity by Rater Across Experimental

Group

	30 sec. M (SD)	60 sec. M (SD)	90 sec. M (SD)	120 sec. M (SD)	150 sec. M (SD)	180 sec. M (SD)	210 sec. M (SD)	240 sec. M (SD)
Rater 1	1.4 (1.1)	1.5 (1.3)	1.3 (1.1)	1.1 (0.65)	0.96 (0.57)	0.96 (0.53)	0.91 (0.43)	1.0 (0.48)
Rater 2	3.3 (1.8)	3.8 (2.0)	2.8 (1.4)	2.6 (1.4)	2.4 (1.3)	2.2 (1.3)	2.0 (1.2)	2.0 (1.2)
Rater 3	3.7 (1.5)	3.2 (1.5)	4.1 (2.0)	4.0 (1.9)	4.2 (1.9)	4.2 (1.9)	4.4 (2.0)	4.5 (2.1)

Table 17

Pearson Correlations (r) of VAS Ratings of Observed Pain-Related Facial Activity between Raters and Intraclass Correlation

(ICC) as an Index of Rater Reliability at Each Rating Time

	30 sec.	60 sec.	90 sec.	120 sec.	150 sec.	180 sec.	210 sec.	240 sec.
Rater 1 vs. **Rater 2**	0.71 $p = 0.000$	0.61 $p = 0.000$	0.66 $p = 0.000$	0.47 $p = 0.000$	0.33 $p = 0.002$	0.39 $p = 0.000$	0.24 $p = 0.04$	0.29 $p = 0.01$
Rater 1 vs. **Rater 3**	0.38 $p = 0.000$	0.33 $p = 0.002$	0.28 $p = 0.012$	-0.07 $p = 0.54$	-0.08 $p = 0.46$	-0.18 $p = 0.12$	-0.29 $p = 0.008$	-0.14 $p = 0.226$
Rater 2 vs. **Rater 3**	0.55 $p = 0.000$	0.57 $p = 0.000$	0.58 $p = 0.000$	0.54 $p = 0.000$	0.50 $p = 0.000$	0.45 $p = 0.000$	0.46 $p = 0.000$	0.51 $p = 0.000$
ICC	0.3	0.31	0.27	0.18	0.13	0.12	0.09	0.12

Table 18

Pearson Correlations (r) Between Self-Report Ratings of Pain Intensity and CFCS Scores for Children

	CFCS Minute 1	CFCS Minute 2	CFCS Minute 3	CFCS Minute 4	Self-Report Minute 1	Self-Report Minute 2	Self-Report Minute 3	Self-Report Minute 4
CFCS Minute 1	-				0.522 $p=0.00$	0.486 $p=0.000$	0.302 $p=0.004$	0.158 $p=0.141$
CFCS Minute 2	0.743 $p=0.000$	-			0.461 $p=0.00$	0.491 $p=0.000$	0.406 $p=0.000$	0.283 $p=0.008$
CFCS Minute 3	0.463 $p=0.000$	0.611 $p=0.000$	-		0.299 $p=0.005$	0.312 $p=0.003$	0.233 $p=0.029$	0.210 $p=0.050$
CFCS Minute 4	0.404 $p=0.000$	0.600 $p=0.000$	0.566 $p=0.000$	-	0.167 $p=0.131$	0.199 $p=0.072$	0.157 $p=0.158$	0.150 $p=0.175$
Self-Report Minute 1					-			
Self-Report Minute 2					0.823 $p=0.000$	-		
Self-Report Minute 3					0.582 $p=0.000$	0.797 $p=0.000$	-	
Self-Report Minute 4					0.417 $p=0.000$	0.635 $p=0.000$	0.871 $p=0.000$	-

Table 19

Pearson Correlations (r) Between Secondary Covariates, Self-Report Ratings of Pain Intensity and CFCS Scores for Children

	CFCS Minute 1	CFCS Minute 2	CFCS Minute 3	CFCS Minute 4	Self-Report Minute 1	Self-Report Minute 2	Self-Report Minute 3	Self-Report Minute 4
PCS	0.125 $p=0.230$	0.099 $p=0.349$	0.110 $p=0.307$	-0.029 $p=0.793$	0.236 $p=0.021$	0.226 $p=0.030$	0.184 $p=0.083$	0.158 $p=0.138$
IBES - Parent	0.033 $p=0.752$	0.030 $p=0.775$	0.045 $p=0.679$	0.042 $p=0.707$	-0.133 $p=0.196$	-0.163 $p=0.118$	-0.215 $p=0.042$	0.207 $p=0.051$
IBES -Child	0.032 $p=0.762$	0.097 $p=0.397$	0.058 $p=0.592$	0.215 $p=0.050$	-0.013 $p=0.901$	0.072 $p=0.495$	0.057 $p=0.592$	0.052 $p=0.623$
STAI - C State	-0.018 $p=0.867$	-0.086 $p=0.422$	-0.019 $p=0.864$	-0.065 $p=0.560$	0.026 $p=0.803$	-0.117 $p=0.266$	-0.134 $p=0.211$	-0.205 $p=0.054$
STAI - C Trait	-0.022 $p=0.832$	0.039 $p=0.718$	0.027 $p=0.801$	0.011 $p=0.923$	0.133 $p=0.198$	0.150 $p=0.154$	0.141 $p=0.188$	0.142 $p=0.186$

PCS = Pain Catastrophizing Scale

IBES = Illness Behavior Encouragement Scale

STAI - C = State-Trait Anxiety Inventory for Children

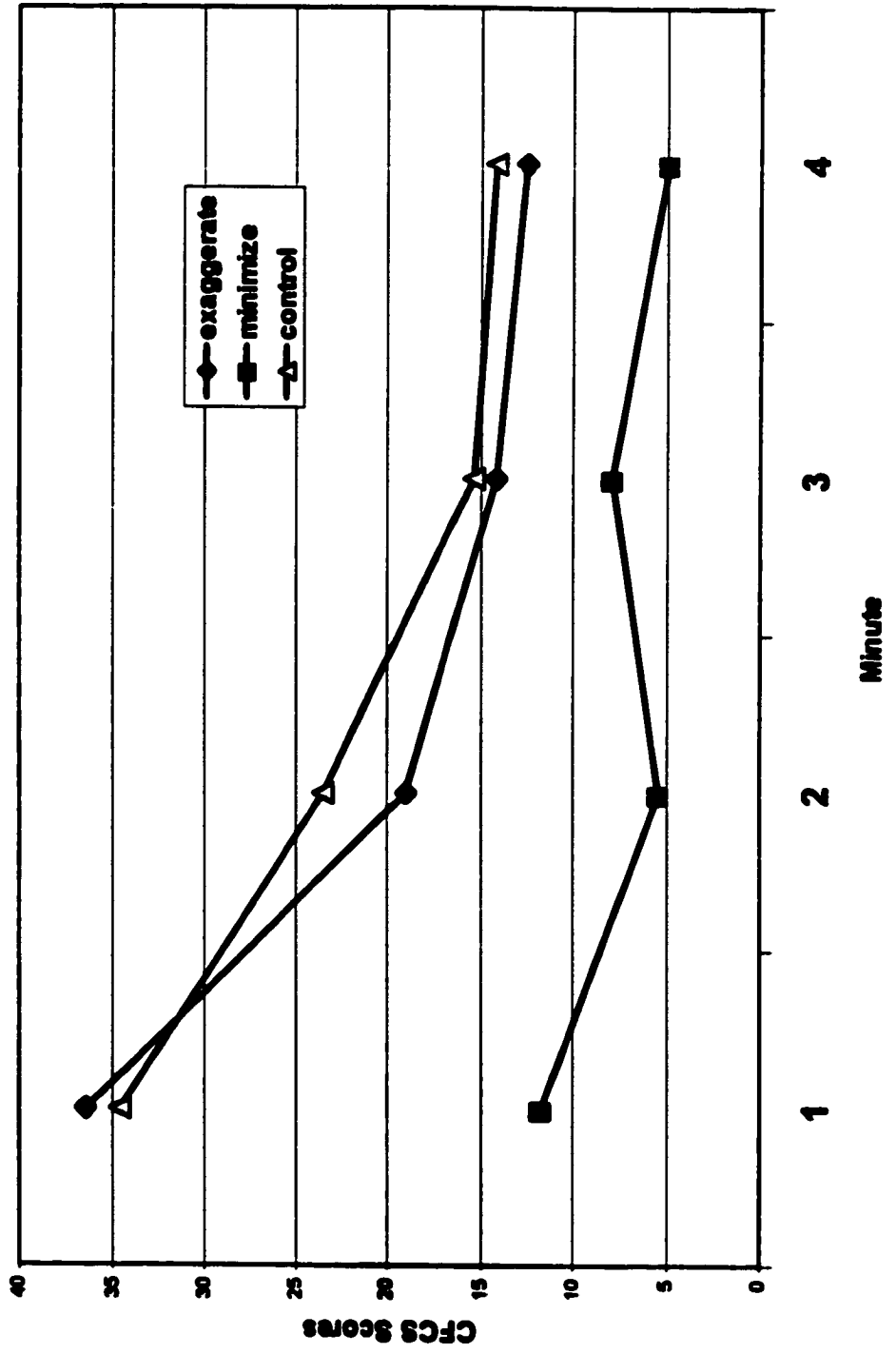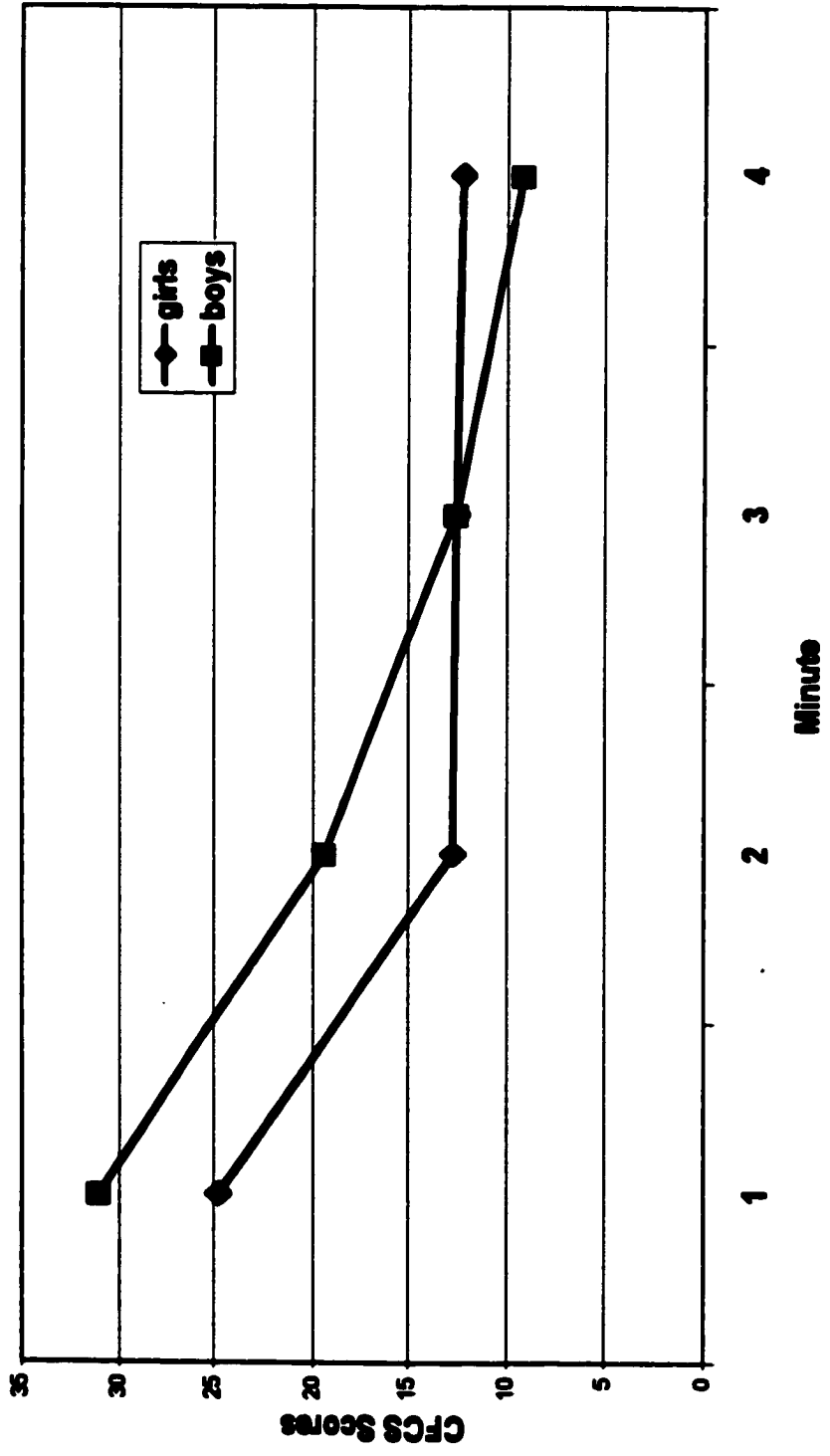Figure 1: CFCS Scores by Experimental Group

Figure 2: CFCS Scores by Gender

Appendix A

Sample Child Pain Diary

The Dalhousie Pain Study

All information collected will remain confidential among the researchers involved in this study. Personal or identifying information will not be given or available to anyone, including any members of your family, except where your safety is of concern. Please read the instructions below and go on to the next page.

The purpose of this study is to find out how much everyday pain experiences interfere with daily actirvities in each member of a family.

In this study, you and each member of your family will complete a daily diary for 7 days in a row. The diary will ask you to record how much pain you have had during this 7-day period and how much it interfered with your activities. We ask that you complete the diary every day at the same time, just before you go to bed.

When the 7-day period is over, you should seal your diary closed with one of the stickers we have provided in your package. The diaries for each member of your family should be returned together in the large, stamped return envelope.

Thank you for your help.

Your Name: _____

Work, Leisure & Exercise

We are trying to understand the relation between pain and work, leisure, and exercise activities. If you have a part-time or full-time job, write what job it is and how many hours per week you work in the space below (e.g., sales clerk, 10 hours per week; babysitter, 15 hours per week).

_____

Does your work involve any of the following repetitive activities? Check the right box.
Lifting more than 10 lbs. ___hours/week   sitting ___hours/week
keyboarding/typing ___hours/week   standing ___hours/week
walking ___hours/week
other_____ hours/week

Are you exposed to anything else in your job that might cause pain? Please list _____

What kind of leisure or exercise activities do you do on a regular basis. Check the appropriate box(es):

___ bicycling ____hours/week   ____soccer ____hours/week
___ watching TV ____hours/week   ____walking____hours/week
___ playing with toys ____hours/week ____swimming ____hours/week
____playing a musical instrument (specify) _____hours/week
____reading ____hours/week
____others (specify) _____hours/week

If you are still in school, what grade are you in? _____

If you are not in school, what was the last grade you finished? _____

What is your date of birth: Year_____ Month _____ Day _____

Related Medical Information

In the space provided, list any medical problems that you have (for example: asthma, diabetes, etc.) Leave spaces black if you don't have any medical problems:

_____

_____

_____

In the space provided, list any pills, drugs, or medicine that you take on a regular basis (for example, every day or every week). Beside each kind of medicine, write how often you take it. Leave spaces blank if you don't usually take any medicine.

_____

_____

_____

How Do I Fill Out My Daily Pain Diary?

This is an example of what an entry for each day looks like in your Daily Pain Diary.

Day 1 - January 5, 1993   No Pain ❑   Pain ❑ Doctor Visit? ❑

Everyday, when you are filling out this diary, we want you to think about whether or not you had any kind of pain during the day.

For example, let's think about today. If you did have pain today, you would mark an X in the box beside 'Pain'. Then, you would fill out a Pain Report Form. The Pain Report Forms are the pages in the back of your diary. If you had more than one kind of pain today, you would fill out a separate Pain Report Form for each different kind of pain. For example, if you had a headache and pain in your knee today, you would fill out one Pain Report Form for your headache and one for your knee pain. If you run out of Pain Report Forms, we have put extra ones in the package sent you your home. For the extra Pain Report Forms that you use and put them in your booklet before you seal it closed.

If you made an appointment with a doctor, or went to see a doctor becasue of the pain you had today, you would check the box beside Doctor Visits. If you didn't have any pain today, you would mark an X in the box beside No Pain. That is all you have to do on the days when you don't have any pain. Remember to fill out the diary every night just before you go to bed. The diary begins on the next page.

Daily Pain Diary

Please fill in the date in the space provided:

Day 1 _____ No Pain ❑   Pain ❑ Doctor Visit? ❑

Day 2 _____ No Pain ❑   Pain ❑ Doctor Visit? ❑

Day 3 _____ No Pain ❑   Pain ❑ Doctor Visit? ❑

Day 4 _____ No Pain ❑   Pain ❑ Doctor Visit? ❑

Day 5 _____ No Pain ❑   Pain ❑ Doctor Visit? ❑

Day 6 _____ No Pain ❑   Pain ❑ Doctor Visit? ❑

Day 7 _____ No Pain ❑   Pain ❑ Doctor Visit? ❑

Note:
Check in the box beside Doctor Visit? if you went to see a doctor or made an appointment with a doctor because for the pain you had on that day.

Don't forget that if you marked an X beside Pain, fill out one of the Pain Report Forms in the back of your diary. If you have run out of Pain Report Forms, there are extra ones in the package sent to your home.

Pain Report Form

Today's date:_____

Where was your pain? Mark an X on the diagram below to show where you felt your pain.

- Insert body drawing here -

What do you think caused this pain? In the space below, tell what caused your pain (leave blank if you don't know).

_____

Circle the face that shows how you felt during this pain.

- Insert Bieri et al. (1990) Faces Pain Scale Here -

How long did this pain last today?
❑ between 1 second and 30 minutes   ❑ between 30 minutes and 3 hours
❑ between 3 hours and 12 hours   ❑ between 12 and 24 hours

Did you take any medicine to make your pain feel better? ❑ Yes   ❑ No
If yes, what kind? _____ What dosage? _____

If you marked yes, how much did it help your pain?
Circle the best number to show how much the medicine helped your pain.

1	2	3	4	5
not at all	a little bit	some	quite a bit	very much

Pain Report Form (continued)

When people have pain, it is sometimes difficult for them to do their regular activities. Did you have any physical trouble or difficulty doing these activities today because of this pain? Circle the best answer. If you didn't do one of these activities today, check the box Not Applicable (n/a) for that activity.

Walking to the bathroom ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Walking up the stairs ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Doing something with a friend ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Doing chores or housework ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Eating regular meals ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Being up all day without a nap ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Riding the bus or traveling by car ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Being at school all day ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Doing activities in gym class (or playing sports) ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Reading or doing work at home ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Watching TV ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Walking the length of a football field ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Running the length of a football field ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Going shopping ❑ n/a	no trouble	a little trouble	some trouble	a lot of trouble	impossible
Getting to sleep or staying asleep ❑	no trouble	little trouble	some trouble	a lot of trouble	impossible

Appendix B

Telephone Script from Study 1

Step 1. Using the outlined procedure, select a highlighted telephone number from the section of the telephone book assigned to you.

Step 2. Record the telephone number and the name of the contact person in your telephone log.

Possible Outcomes:

1. No answer - mark n/a under the "n/a-busy" column of your telephone log and record the time in the "time" column. Try the number later.

2. Busy signal - mark "busy" under the "n/a-busy" column of your telephone log and record the time in the "time" column. Try the number later.

3. If some answers - "Hello, may I please speak to <u>person's name</u> from phone book (e.g., M. Wilson, John Doe - do not use Miss, Ms., Mrs. Or Mr., etc. unless title is clearly identified in phone book).

In cases of....

Call waiting - If whomever answers says, "I'm on the other line, can I take a message" or "Can I get her to call you back?", reply, "No thank you, I'll call back later. When would be a good time to try again?" Note suggested time to try again and "call waiting" in comments column of log.

Wrong number - Ask, "Is this (say phone number)?". If it is the number, note "wrong number" in the comments column and go on to the next call. If you dialed the number incorrectly, try again.

Not home/unavailable - Say, "Well maybe you can help me," and introduce the study as if you had reached the contact person (see top of page 2). If they give an indication that they do not live in the home, or that they're not a family member, reply, "I'll call back later. When do you think they will be at home?, or when would be a good time to try again?" Note that the contact was "not home" in the comments column with the suggested time.

Answering machine - do not leave message. Hang up, note time, and try again later.

In cases when the target is at home.....

"Hello, my name is (give first and last name). I am calling from the Pain Research Laboratory at Dalhousie University. I am part of a research team headed by Dr. Pat McGrath and we are doing a study looking at how often children and their family members experience pain, and how much it interferes with their daily activities. We are looking for families to participate in this study who have children between the ages of 8 and 18 years, and who are currently living at home. Do you have children between the ages of 8 and 18?"

If no, reply "I'm sorry to bother you, thank you for your time." Record "no" in proper column of telephone log along with any relevant comments (i.e., no children, children too young/ too old).

If they say yes, say"

"Let me tell you a bit more about our study"

If they indicate that it is not a good time, ask if you can call back at a more convenient time. Record the call-back time in log.

If they are not interested in hearing more, thank them and record a "no" under the proper column of the log.

If they are interested, tell them:

"This study is looking at the everyday pain experiences in families with children. If your family agrees to participate, each member of your family living with you will receive a pain diary in the mail. The diary is a small booklet used to record whether or not you have had pain on a given day, how severe the pain was, and how much it interfered with your daily activities. Each family member will be asked to record their pain in the diary every day for one week. This only takes about 1-2 minutes per day. Do you think you might be interested in participating in this study?"

If no, reply, "thank you for your time" and record in log.

If they respond with any variation of "I'm not sure" or "tell me more about it" Add:

"We will send you an information package in the mail which will include more detailed information about the study, a pain diary for each family member, and instructions on how to complete the diary. Each family member will fill out the diary for 7 days in a row, and then seal it with the seals provided. You will then mail the completed diaries back to us in

the one big envelope that we provide with postage. Can I send you an information package?"

If no, say, "Thank you for your time" and record in log.

If they say "yes", record the following information in the Family Profile Form:

- complete mailing address
- names, ages, genders, of children living in the home
- what other adults are living in the home.

Say, "OK, Mr./Mrs. _____, your information package will be mailed tomorrow. If you have any additional questions about the study, the information package will provide the name and telephone number of the research coordinator of this project. I will be calling you again in about a week to make sure you have received your package and to see if you have questions. Thank you for your time and your interest."

Letter Explaining Nature and Purpose of Study 1
The Dalhousie Pain Study

Dear Participants,

Introduction and Purpose
You and each member of your family who is currently living with you have been asked to participate in the Dalhousie Pain Study. This is a research study being conducted at the Department of Psychology at Dalhousie University. This study is being carried out by Dr. Patrick J. McGrath, Professor of Psychology, Pediatrics, and Psychiatry at Dalhousie University, Dr. Heather Chipuer, Assistant Professor of Psychology at Saint Mary's University,, and Julie Goodman, research coordinator of the Dalhousie Pain Study. Health and Welfare Canada is funding this study.

The purpose of this study is to find out the extent to which everyday pain experiences interfere with daily activities in each member of a family. This is an important area of study because pain cause much physical and mental suffering and often reduces the ability of people to work, go to school, or maintain relationships with others. As well, pain is a major cost to our health care system.

Nature of Study
In this study, you and each member of your family will be asked to complete a daily diary for 7 days. The diary will ask you to record the occurrence, severity, frequency and duration of all pain that you have had during the 7-day period. We ask that you complete the diary every day at the same time, just before you go to bd. The questions in the diary can be answered by children with no or minimal supervision from an adult. We have enclosed a diary for each member of you family who is 1) Currently living with you and 2) age 8 or older. If you run out of room in your diary before the 7 days are over, we have included extra pages for children and adults.

When the 7-day period is over, each member of your family should seal their diary closed with one of the stickers that we have provided. You can then collect the sealed diaries from each person and mail them together in the large envelope that we have provided. This envelope has the correct address and postage, so all you have to do is put the diaries in the envelope and mail it.

Risks and Benefits
There are no known physical or psychological risks of participating in this study. While it is unlikely that you will benefit personally, your participation will help us to better understand whether people in the same family have similar pain problems, and whether pain problems affect family members in the same way.

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Withdrawal from the Study
Participation in this study is entirely voluntary for all members of your family. You or any member of your family can refuse to participate or withdraw from participating in this study at any time for any reason. If one or more members of your family are not interested in taking part in this study, this does not mean that your family is no longer eligible to participate. Your family can take part as long as there is one parent and one child who agree to participate.

If you have decided not to participate, we ask that you fill out the small white refusal slip that we have included and return all of the material included in this package in the large envelope. We ask this of you to help reduce the costs of the study and to avoid excessive waste paper.

Confidentiality
All information collected in these diaries is confidential and will not be available to anyone outside the research team. However, should we believe that the safety of your child(ren) is in danger because of pain, we would contact you and would be obliged to provide this information to the proper authorities. Furthermore, you or any other member of your family will not be identified in any scientific communication based on the results of this study.

If you have any questions, please feel free to contact the study office any time at (902) 494-1938.

Sincerely,

.

Julie E. Goodman
Research Coordinator

Patrick J. McGrath, Ph.D.
Professor of Psychology,
Pediatrics, and Psychiatry
Coordiantor, Clinical
Psychology

Heather Chipuer, Ph.D.
Assistant Professor of
Psychology
Saint Mary's University

Appendix D

Recruitment Telephone Script for Study 2

Step 1.   Select name from list provided to you.

Step 2.   Record the name and telephone number in your telephone log.

Possible Outcomes:

1.   No answer - mark n/a under the "n/a-busy" column of your telephone log and record the time in the "time" column. Try the number later.

2.   Busy signal - mark "busy" under the "n/a-busy" column of your telephone log and record the time in the "time" column. Try the number later.

3.   If some answers - "Hello, may I please speak to person's name from phone book (e.g., M. Wilson, John Doe - do not use Miss, Ms., Mrs. Or Mr., etc. unless title is clearly identified in phone book).

In cases of....

Call waiting - If whomever answers says, "I'm on the other line, can I take a message" or "Can I get her to call you back?", reply, "No thank you, I'll call back later. When would be a good time to try again?" Note suggested time to try again and "call waiting" in comments column of log.

Wrong number - Ask, "Is this (say phone number)?". If it is the number, note "wrong number" in the comments column and go on to the next call. If you dialed the number incorrectly, try again.

Not home/unavailable - Say, "Well maybe you can help me," and introduce the study as if you had reached the contact person (see top of page 2). If they give an indication that they do not live in the home, or that they're not a family member, reply, "I'll call back later. When do you think they will be at home?, or when would be a good time to try again?" Note that the contact was "not home" in the comments column with the suggested time.

Answering machine - do not leave message. Hang up, note time, and try again later.

In cases when the target is at home.....

"Hello, my name is (give first and last name). I am calling from the Pain Research Laboratory at Dalhousie University. In (insert month) of 1993, you and your family participated in a study which looked at how common pain complaints were in families. We are wondering if you and one of your children who is currently between the ages of 10 and 14 would be interested in taking part in another study we are currently doing which looks at the similarities and differences between mothers and children in response to pain. Let me tell you a bit more about our study."

If they indicate that it is **not a good time**, ask if you can call back at a more convenient time. Record the call-back time in log.

If they are **not interested** in hearing more, thank them and record a "no" under the proper column of the log.

If they **are interested**, tell them:

"The Dalhousie Pain Research Lab does many different types of studies on pain at both IWK Children's hospital and the Psychology Department at Dalhousie University. This study takes place at Dalhousie and will help us to better understand how health children learn about pain from their parents. It has been approved by the Dalhousie Human Ethics Research Committee."

"There are two parts to this study. In one part, you and your child will be asked to put your arm in a tub of cold water for as long as you can, but for no longer than 4 minutes. This may be unpleasant, uncomfortable, or mildly painful. The second part of the study involves completing several questionnaires."

"Before taking part in the cold water task, and without your child knowing about it, you will be asked to watch a videotape that shows how we would like you to behave during the cold water immersion. You will either be asked to exaggerate your experience of pain, minimize or down play your experience of pain, or do nothing differently. If you are asked to exaggerate your report of pain, we will ask you to display only moderate pain, so that it will likely not upset your child. It's really important though that your child not know that you may be changing the way you behave during the experiment."

"We are offering a small honorarium of either a t-shirt or $15.00 to both you and your child for participating. Whether you would like your child to receive the honorarium is up to you."

"Participating is completely voluntary, there are no risks involved to you or your child, all information we obtain from you during the experiment will be kept confidential and you

can withdraw from the study at any time. Before deciding whether you'd like to participate, do you have any questions?" Respond to questions as appropriate.

"Would you be interested in participating in this study?"

If no, reply, "thank you for your time" and record in log as eligible but not interested., and note reason, if any.

If yes, inquire about Exclusion Criteria.
"Before we schedule a time for you and your child to come in, because the experiment involves exposure to mild pain, I must ask if you or your child have any of the following medical conditions:

Reynaud's syndrome
Frostbite
Diabetes
Conditions associated with chronic or recurrent pain (give examples fibromyalgia, cancer, arthritis, etc.).
Conditions which require taking medications (for example, for epilepsy, depression, ritalin, etc.)
Pregnancy
Heart condition

If parent or child does have any of these conditions mark in the log, record what condition and in whom, and note ineligible in log.

If parent or child does not have any of these conditions mark yes in the log. Proceed as follows:

"When would be the best time for you and your child to come; weekends or some time after school during the week." Book appointment.

"Thank you for agreeing to participate. We will send directions to you in the mail, along with a reminder card with date and time of your appointment. We will also send a detailed letter outlining the nature of the study and of your participation. We'd like you to bring this letter with you to your appointment. We will call you a day or two before your appointment. Before that time, we would like you to tell your child about the experiment and let him or her decide whether she or he wants to participate. If your child does not want to participate, you can let us know when we call you back. Thanks again."

Appendix E

Reasons for Refusal to Study 2

Reason	Number
Limited Time	18
Transportation difficulties	5
Family Crisis	1
Mother Refused	10
Child Refused	6
Total	40

Appendix F

Demographic Information

I. PARENT INFORMATION

Name of parent: _____   Age of parent: _____

Mailing Address: _____

, _____   phone: _____

_____

Occupation: _____

If not currently working outside the home, previous occupation: _____

Education: _____

Marital Status: □ Married / Common Law   □ Single / Never Married □ Divorced / Separated
                  □ Widowed

Number of children (including child currently participating): _____

Health Problems? _____

Regular Meds? _____

handedness _____

II. CHILD INFORMATION

Name of participating child: _____   □ Male □ Female
                            (first and last name)

Age of Child (years): ____   Date of Birth: Year: _____ Month: _____ Day: _____
Grade: _____

Birth Order of Participating Child:

□ 1st born   □ Other: _____
□ 2nd born
□ 3rd born   handedness _____
□ 4th born
□ 5th born

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Appendix G

HOW I FEEL QUESTIONNAIRE: STAIC Form C-1

Directions: A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide how you feel right now. Then put an X in the box in front of the word or phrase which best describes how you feel. There are no right or wrong answers. Don't spend too much time on any one statement. Remember, find the word or phrase which best describes how you feel right now

1. I feel..............................	❑ very calm	❑ calm	❑ not calm
2. I feel..............................	❑ very upset	❑ upset	❑ not upset
3. I feel..............................	❑ very pleasant	❑ pleasant	❑ not pleasant
4. I feel..............................	❑ very nervous	❑ nervous	❑ not nervous
5. I feel..............................	❑ very jittery	❑ jittery	❑ not jittery
6. I feel..............................	❑ very rested	❑ rested	❑ not rested
7. I feel..............................	❑ very scared	❑ scared	❑ not scared
8. I feel..............................	❑ very relaxed	❑ relaxed	❑ not relaxed
9. I feel..............................	❑ very worried	❑ worried	❑ not worried
10. I feel..............................	❑ very satisfied	❑ satisfied	❑ not satisfied
11. I feel..............................	❑ very frightened	❑ frightened	❑ not frightened
12. I feel..............................	❑ very happy	❑ happy	❑ not happy
13. I feel..............................	❑ very sure	❑ sure	❑ not sure
14. I feel..............................	❑ very good	❑ good	❑ not good
15. I feel..............................	❑ very troubled	❑ troubled	❑ not troubled
16. I feel..............................	❑ very bothered	❑ bothered	❑ not bothered
17. I feel..............................	❑ very nice	❑ nice	❑ not nice
18. I feel..............................	❑ very terrified	❑ terrified	❑ not terrified
19. I feel..............................	❑ very mixed-up	❑ mixed-up	❑ not mixed-up
20. I feel..............................	❑ very cheerful	❑ cheerful	❑ not cheerful

Appendix G (con't)

HOW I FEEL QUESTIONNAIRE: STAIC Form C-2

Directions: A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide if it is hardly-ever, or sometimes, or often true for you. Then for each statement, put an X in the box in front of the word that seems to describe you best. There are no right or wrong answers. Don't spend too much time on any one statement. Remember, choose the word which seems to describe how you usually feel.

1. I worry about making mistakes.......................... ❑ hardly-ever ❑ sometimes ❑ often

2. I feel like crying................................. ❑ hardly-ever ❑ sometimes ❑ often

3. I feel unhappy.................................... ❑ hardly-ever ❑ sometimes ❑ often

4. I have trouble making up my mind.................. ❑ hardly-ever ❑ sometimes ❑ often

5. It is difficult for me to face my problems .... ❑ hardly-ever ❑ sometimes ❑ often

6. I worry too much................................ ❑ hardly-ever ❑ sometimes ❑ often

7. I get upset at home .... ❑ hardly-ever ❑ sometimes ❑ often

8. I am shy .... ❑ hardly-ever ❑ sometimes ❑ often

9. I feel troubled .... ❑ hardly-ever ❑ sometimes ❑ often

10. Unimportant thoughts run through my mind
and bother me..................................... ❑ hardly-ever ❑ sometimes ❑ often

11. I worry about school............................. ❑ hardly-ever ❑ sometimes ❑ often

12. I have trouble deciding what to do................ ❑ hardly-ever ❑ sometimes ❑ often

13. I notice my heart beats fast .... ❑ hardly-ever ❑ sometimes ❑ often

14. I am secretly afraid .... ❑ hardly-ever ❑ sometimes ❑ often

15. I worry about my parents......................... ❑ hardly-ever ❑ sometimes ❑ often

16. My hands get sweaty .... ❑ hardly-ever ❑ sometimes ❑ often

17. I worry about things that may happen .... ❑ hardly-ever ❑ sometimes ❑ often

18. It is hard for me to fall asleep at night .... ❑ hardly-ever ❑ sometimes ❑ often

19. I get a funny feeling in my stomach............... ❑ hardly-ever ❑ sometimes ❑ often

20. I worry about what others think of me............ ❑ hardly-ever ❑ sometimes ❑ often

Appendix H

SELF-EVALUATION QUESTIONNAIRE: STAI Form Y-1

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement, but give the answer which seems to describe your present feelings best.

	not at all	somewhat	moderately so	very much so
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I am at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel confident	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

Appendix H (con't)

SELF-EVALUATION QUESTIONNAIRE: STAI Form Y-2

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement, but give the answer which seems to describe how you generally feel.

	almost never	sometimes	often	almost always
1. I feel pleasant	1	2	3	4
2. I feel nervous	1	2	3	4
3. I feel satisfied with myself	1	2	3	4
4. I wish I could be as happy as others seem to be	1	2	3	4
5. I feel like a failure	1	2	3	4
6. I feel rested	1	2	3	4
7. I am "calm, cool, and collected"	1	2	3	4
8. I feel like difficulties are piling up so that I cannot overcome them	1	2	3	4
9. I worry too much over something that really doesn't matter ...	1	2	3	4
10. I am happy	1	2	3	4
11. I have disturbing thoughts	1	2	3	4
12. I lack self-confidence	1	2	3	4
13. I feel secure	1	2	3	4
14. I make decisions easily	1	2	3	4
15. I feel inadequate	1	2	3	4
16. I feel content	1	2	3	4
17. Some unimportant thoughts run through my mind and bother me	1	2	3	4
18. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
19. I am a steady person	1	2	3	4
20. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Pain Catastrophizing Scale

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain:

0 - not at all   1 - to a slight degree   2- to a moderate degree   3 - to a great degree
                                4 - all the time

When I'm in pain...

____   I worry all the time about whether the pain will end.

____   I feel I can't go on.

____   It's terrible and I think it's never going to get any better.

____   It's awful and I feel that it overwhelms me.

____   I feel I can't stand it anymore.

____   I become afraid that the pain will get worse.

____   I keep thinking of other painful events.

____   I anxiously want the pain to go away.

____   I can't seem to keep it out of my mind.

____   I keep thinking about how much it hurts.

____   I keep thinking about how badly I want the pain to stop.

____   There's nothing I can do to reduce the intensity of the pain.

____   I wonder whether something serious may happen.

____   Total Score

Appendix J
Illness Behavior Encouragement Scale - Parent Form

What happens when your child has pain? The next question are about what you do when your child has pain. For each question, choose one of the answers:

Never	means that you never do this
Hardly Ever	means that you only do this once in a while
Sometimes	means that you do this some of the time.

Often	means that you usually do this.
Always	means that you always do this.

1. How often do you let your child stay home from school when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

2. How often do you say your child does not have to do regular chores such as taking out trash or cleaning up when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

3. How often do you say your child doesn't have to finish all of his/her homework when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

4. How often do you bring your child special treats, or little gifts when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

5. How often do you insist that your child go to school when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

6. How often do you still expect your child to do chores and homework when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

7. How often do you take your child to the doctor when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

8. How often do you spend more time than usual with your child when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

9. How often do you give your child special privileges or let him/her do things he or she isn't usually allowed to do when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

10. How often do you stay home from work or come home early when she/he has pain?

Never   Hardly Ever   Sometimes   Often   Always

11. How often do you pamper or spoil your child when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

12. How often do you tell other people in the family not bother your child or to be especially nice to your child when he/she has pain?

Never   Hardly Ever   Sometimes   Often   Always

Numerical Rating Scale

0 1 2 3 4 5 6 7 8 9 10

Appendix L

Visual Analogue Scale

Appendix M

Brief Description and Review of Study 2 Provided to Mother-Child Pairs

Let me tell you a bit more about the study. This is a project being carried out by myself, Julie Goodman who is a Ph.D. student in Clinical Psychology here at Dal. The project is part of my thesis research.

We're interested in how children learn about pain from their parents. The project has two parts. The first part involves filling out some questionnaires, kind of like multiple choice questionnaires - they ask about the types of thoughts and feelings you usually have when you have pain, how you usually react to your child when she/he indicates pain, the types of feelings that you usually have, not just when you have pain, but more generally, and the last one asks about the types of things that you usually do for yourself when you have pain, how you usually cope with pain - that type of thing. The second part of the study involves putting your arm in a tank of cold water for about 4 minutes. That activity has been designed to be unpleasant and painful. Although it is usually painful, there is absolutely no risk of harm or injury to you or your child - there are not lasting effects. Regarding both activities, the questionnaires and the cold water part, you are in complete control at all times. So if, for example, there are particular questions on the questionnaires, that you are not comfortable asking, you may leave them blank. Same thing applies to the cold water part - although we ask that you try to keep your arm in the water for the full 4 minutes, you can take it out at any time, for whatever reason.

All the information that I'll collect from you tonight will be kept confidential to myself, to Beth Currie (the person who called you) and her supervisor, Dr. Patrick McGrath. So only the 3 of us will have access to your information. We do videotape you during the experiment, but again, only the 3 of us will have access to your tapes.

You and (name of child) will each have a choice between $15.00 and one of our lab t-shirts (show them one) when we're all finished.

Do you have any questions? Answer questions as appropriate.

What we usually do is get you started on the questionnaires first, and then we'll show you a demonstration video that will walk you through the cold water part of the experiment and will show you exactly what we want you to do, and any other questions that come up then can be answered at that time.

Sign consent letter. Complete first 3 questionnaires (PCS, IBES, STAI).

Consent Form for Study 2   .

Consent to act as a subject in a research study

The impact of a parent's behaviour on their child's pain

Investigators

Julie Goodman, Ph.D. Candidate
Psychology Department
Dalhousie University
Halifax, NS

Patrick J. McGrath, Ph.D.
Psychology Department
Dalhousie University
Halifax, NS

Introduction and Purpose

You and your child have been asked to take part in a research project which looks at the similarities and differences between mothers and children in how they respond to a mildly painful experience. Research in this area has shown that family factors may be related to the development of pain problems in children, but most of this research has been conducted on children who have recurrent pain problems or chronic illnesses. This research will help us better understand how healthy children learn about pain from their parents.

This study is being carried out by Julie Goodman, a doctoral student in Clinical Psychology at Dalhousie University and Dr. Patrick J. McGrath, Professor of Psychology, Pediatrics, Psychiatry and Occupational Psychology at Dalhousie University.

Nature of Study

If you choose to participate in this study, you and your child will be asked to participate in an activity at Dalhousie University which will look at your and your child's reactions to mild pain. During this activity you and your child will be asked to put your arm in a tub of cold water for no longer than 4 minutes. This may become mildly painful. You and your child will also be asked to fill out several questionnaires about how you and your child cope with pain, whether you and your child experience anxiety about being in pain, and what sorts of things you do for your child when your child is in pain. The entire visit to Dalhousie will take about one hour.

Expenses

If you choose to take part in this study, you and your child will each receive a small honorarium ($15.00 or a t-shirt). This honorarium will include a reimbursement for any transportation costs in travelling to Dalhousie University.

Risks and Benefits

The activity that involves putting your arm in cold water may be unpleasant, uncomfortable or even painful. However, none of the activities you or your child will be asked to do will involve any risk of injury. While it is unlikely that you will benefit personally by taking part in this study, your participation will help us to better understand how healthy children learn about pain from their parents.

Withdrawal From the Study

Taking part in this study is entirely voluntary. You and your child are free to refuse to participate and you and your child may also enter the study and withdraw at any time.

Confidentiality

All identifying information will be kept confidential. Any publications or presentations of the results of this study will include only group data and will not include any individual data. Should you decide at a later date to withdraw from this study, after completing all the activities requested from you and your child, your data will not be included in the results of this study.

Voluntary Consent

I have read this consent form or have had it read to me and I understand its contents. I have had the opportunity to ask questions and understand that any further questions can be answered by contacting Julie Goodman at 494-1938 or Dr. Patrick McGrath at 494-3581.

My signature below indicates that I freely agree to participate in this study and that I give consent for my child to participate. The signature of my child indicates that he or she understands what they are asked to do during the study activities, and that he/she also freely agrees to participate.

Name of parent (please print) _____

Signature of parent _____ Date _____

Name of child (please print) _____

Signature of child _____ Date _____

Signature of Investigator _____ Date _____

Signature of Witness _____ Date _____

Text of Demonstration Video   .

This demonstration video will show you exactly what you're supposed to do during the experiment that you will be doing today. I will go through things step-by-step for you, but if you have any questions, please ask one of us. It's really important that you know exactly what we want you to do.

You and your mother will be together in this room. Your mother will do the experiment first. While she is doing the experiment, you will sit on this couch and watch her. When it is your turn, your mother will sit on the couch and watch you. We have two water tanks, with a chair beside each one. The video cameras on the wall and on the floor will be used to tape you and your mother during the experiment. Through this speaker, you will hear a set of taped instructions that will tell you exactly what to do. During the experiment, I will be sitting in the next room and watching on the video monitor that you are watching now. If you have any questions, I will be able to hear you through the video monitor and can answer through the intercom system.

Jaime is going to demonstrate for you exactly what you're supposed to do during the experiment...

Room Temperature Water Immersion

The first water immersion will be in a tank of room-temperature. First, sit in the chair beside water tank #1 and put one of the towels on your lap. Remove your watch, if you're wearing one, your rings, or other jewelry that you are wearing on the arm that you'll be using. If you a wearing a long-sleeved shirt, roll up your sleeve. Now rest your arm in the cradle of the tank, that's the mesh part. Be sure not to let your arm touch the water. Wait for the tape to tell you to lower your arm into the water. When you hear the tape say, "slowly lower you arm into the water", push the cradle down into the water so that it touches the bottom of the tank. After 2 minutes, the tape will ask you to remove your arm. Keep you arm in the water until the tape says to remove it. When you hear the tape say, "raise the cradle out of the water", slowly raise the cradle out of the water. You can then dry your arm off with the towel.

The tape will then tell you to go and sit in the chair beside water tank #2. Bring your towel with you and keep it on your lap.

Cold Water Immersion

Rest your arm in the cradle of the tank, without letting your arm touch the water. Wait for the tape to tell you to lower your arm into the water. When you hear the tape say, "slowly

lower you arm into the water", push the cradle down into the water so that it touches the bottom of the tank. When you put your arm in the water, it will feel cold. When you arm first starts to hurt, let us know by raising your other hand briefly, like this. Keep you arm in the water as long as you possibly can. The tape will tell you when to take your arm out of the water. If you cannot stand it anymore, then you may take your arm out before the tape tells you to.

Throughout this immersion, the tape will ask you to write down how much your arm hurts using the number scales on the table in front of you. When the tape says, "how much does your arm hurt now?", rate how much your arm hurts on a scale of 0 to 10. 0 means that it doesn't hurt at all and 10 means that it is the worst hurt you can possibly imagine. Circle a number from 0 to 10 on your sheet in front of you, without taking your arm out of the water. Use the number scales in the order that they appear to you on the table. When you have finished making your rating, turn the page over so that you can't see it. Keep listening to the tape, it will tell you when to make your next rating.

When the tape says, "raise the cradle out of the water", slowly raise the cradle out of the water, but leave your arm resting on it over the water. The tape will then ask you again, "how much does your arm hurt now?" When you have made this rating, you can dry your arm off.

Appendix P

Text of Control Video

Hi there. Thank you for agreeing to participate in this research project. This project is only one of many research projects currently taking place at the Pain Research Lab. We wanted to take this opportunity to tell you a little bit more about our lab and why your contribution of time is so important to us.

The Pain Research Lab is primarily interested in better understanding and managing pain in children and adolescents. The director of our lab is Dr. Patrick McGrath. Dr. McGrath is the co-ordinator of Clinical Psychology at Dalhousie University He is also the psychologist for the IWK-Grace Health Centre's Pain and Palliative Care Program.

The Lab has two sites. The research here at the Psychology Department at Dalhousie University focuses on the everyday pain experiences of healthy children and families. As you know from taking part in the pain diary study in 1993, we have examined such things as how common and severe pain complaints are in families. We have also looked at how parents typically respond to their child when the child has pain, and what is the best way of measuring pain in children. Through this research, we hope to increase our understanding of how children learn about pain from their families and peers.

The research that is ongoing at the IWK-Grace Health Centre focuses on pain related to medical conditions and procedures. We have examined such areas as how parents manage postoperative pain following day-surgery, management of cancer pain and pain from other chronic medical conditions such as arthritis. We have also researched how children and their parents cope with painful medical conditions such as migraine headache. Both labs are interested in the role that families play in the development and expression of pain in children and adolescents.

During the experiment, you and your child will be asked to immerse your arm into this tank. Sit as close to the tank as you can. Lay your arm on the blue mesh, with your hand laying flat. Try to keep your hand as close to the end of the cradle as you can. A set of taped instruction will be played for you. When the tape says to lower your arm into the water, push the cradle to the bottom of the tank. Then, just follow the instructions played for you on the tape - the tape will tell you exactly what to do. Although the water is cold, and may cause pain, there is no risk of harm to you or your child.

The tanks are emptied daily and cleaned with soap and water. They are also disinfected with Javex each time they are cleaned.

Once again, thank you for taking part in this study. Your participation will help us to understand how children learn about pain from their parents.

Appendix Q

Debriefing for Mothers and Children - Study 2 .

FOR "EXAGGERATE" CONDITION

Ms. (insert last name) and (insert child's name), you have just participated in an experiment that was designed to help us better understand how children learn about pain from their parents. (Insert child's name), when we asked your mother to come with us after you watched the first video, we asked your mother to watch a second video that showed an actress doing the same cold water immersion that you did. The actress on this video showed a lot of pain when her arm was in the water. We asked your mother to behave just like the actress did. We did this to see if it would change the way that you behaved during your cold water immersions. Because you saw your mother showing a lot of pain, we thought that you also would show a lot of pain.

Some of the mothers who also took part in this study were told to show very little pain and were shown videos of an actress who showed very little pain when her arm was in the water. We thought that their children would also show very little pain during the cold water immersions.

Some of the mothers who also took part in this study were given the same instructions as you; the second video that they saw only showed an adult putting her arm in the water, and was almost the same as the first video you both saw. They were not told to exaggerate or reduce the amount of pain they showed. They were given no specific instructions about how much pain to show. We thought that there would be less similarity between mothers and children in this condition, than in the others.

Do you have any questions about the experiment?
Would you like to see the video that your mother saw before she did her cold water immersions?

FOR "MINIMIZE" CONDITION

Ms. (insert last name) and (insert child's name), you have just participated in an experiment that was designed to help us better understand how children learn about pain from their parents. (Insert child's name), when we asked your mother to come with us after you watched the first video, we asked your mother to watch a second video that showed an actress doing the same cold water immersion that you did. The actress on this video showed very little pain when her arm was in the water. We asked your mother to behave just like the actress did. We did this to see if it would change the way that you behaved during your cold water immersions. Because you saw your mother showing very little, we thought that you also would show very little pain.

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Some of the other mothers who also took part in this study were told to show a lot of pain and were shown videos of an actress who showed a lot of pain when her arm was in the water. We thought that their children would also show a lot of pain during the cold water immersions.

Some of the mothers who also took part in this study were given the same instructions as you; the second video that they saw only showed an adult putting her arm in the water, and was almost the same as the first video you both saw. They were not told to exaggerate or reduce the amount of pain they showed. They were given no specific instructions about how much pain to show. We thought that there would be less similarity between mothers and children in this condition, than in the others.

Do you have any questions about the experiment?
Would you like to see the video that your mother saw before she did her cold water immersions?

FOR "NO INSTRUCTION" CONDITION

Ms. (insert last name) and (insert child's name), you have just participated in an experiment that was designed to help us better understand how children learn about pain from their parents. (Insert child's name), when we asked your mother to come with us after you watched the first video, we asked your mother to watch a second video that showed an adult actress doing the same cold water immersion that you did. Your mother was not given any specific instructions about how much pain to show during her immersions. We did this to see if it would change the way that you behaved during your cold water immersions. We thought that there would be less similarity between mothers and children in this condition, than in the others.

Some of the other mothers who also took part in this study were told to show a lot of pain and were shown a video of an actress who showed a lot of pain when her arm was in the water. We thought that their children would also show a lot of pain during the cold water immersions.

Some of the mothers who also took part in this study were told to show very little pain and were shown videos of an actress who showed very little pain when her arm was in the water. We thought that their children would also show very little pain during the cold water immersions.

Do you have any questions about the experiment?

Would you like to see the video that your mother saw before she did her cold water immersions?

Appendix R

Summary of Continuous Demographic Variables by Experimental Group

Variable	Exaggerate (n=32)		Minimize (n=32)		Control (n=32)	
	M	**SD**	**M**	**SD**	**M**	**SD**
Child Age	12.6	1.19	12.7	1.24	12.6	1.04
Mother Age	41.4	4.46	40.4	3.4	41.2	4.9
Number of Children	2.4	1.2	2.3	0.81	2.1	0.71

Appendix S

Summary of Categorical Demographic Variables by Experimental Group

Variable	Exaggerate		Minimize		Control	
	%	(N)	%	(N)	%	(N)
Mother Handedness						
Right	87.5	(28)	87.5	(28)	90.6	(29)
Left	12.5	(4)	12.5	(4)	9.4	(3)
Total	100.0	(32)	100.0	(32)	100.0	(32)
Marital Status						
Married/Common Law	93.8	(30)	90.6	(29)	90.6	(29)
Separated/Divorced	0	(0)	3.1	(1)	0	(0)
Single/Widowed	6.3	(2)	6.3	(2)	9.4	(3)
Total	100.0	(32)	100.0	(32)	100.0	(32)
Birth Order						
First	53.1	(17)	46.9	(15)	50.0	(16)
Second	25.0	(8)	37.5	(12)	43.8	(14)
Third	15.6	(5)	9.4	(3)	6.3	(2)
Fourth	6.3	(6)	6.3	(2)	0.0	(0)
Total	100.0	(32)	100.0	(32)	100.0	(32)
Child Handedness						
Right	87.5	(28)	100.0	(32)	78.1	(25)
Left	12.5	(4)	0.0	(0)	21.9	(7)
Total	100.0	(32)	100.0	(32)	100.0	(32)
Child Grade						
Four	0.0	(0)	3.1	(1)	3.1	(1)
Five	31.3	(10)	18.8	(6)	12.5	(4)
Six	21.9	(7)	28.1	(9)	25.0	(8)
Seven	18.8	(6)	12.5	(4)	40.6	(13)
Eight	25.0	(8)	31.3	(10)	1536	(5)
Nine	3.1	(1)	6.3	(2)	3.1	(1)
Total	100.0	(32)	100.0	(32)	100.0	(32)

Appendix S (continued)

Variable	Exaggerate		Minimize		Control	
	%	(N)	%	(N)	%	(N)
Mothers' Education						
Grade 12 or Less	21.9	(7)	18.8	(6)	25.0	(8)
College	18.8	(6)	28.1	(9)	25.0	(8)
University	43.8	(14)	37.5	(12)	31.3	(10)
Graduate School	15.6	(5)	15.6	(5)	16.7	(6)
Total	100.0	(32)	100.0	(32)	100.0	(32)
Mothers' Employment Status						
Full-Time						
Part-time	37.5	(12)	46.9	(15)	43.8	(14)
Not Working	40.6	(13)	37.5	(12)	34.4	(11)
Total	21.9	(7)	15.6	(5)	21.9	(7)
	100.0	(32)	100.0	(32)	100.0	(32)

Appendix T

Proportion of Children Indicating and Not Indicating Threshold

by Experimental Group, Child Gender, and Age Group

Group	Indicated Threshold (n=80) % (n)	Did Not Indicate Threshold (n=16) % (n)
Exaggerate	35% (28)	25% (4)
Minimize	30% (24)	50% (8)
Control	35% (28)	25% (4)

Child Gender

	Indicated Threshold (n=80) % (n)	Did Not Indicate Threshold (n=16) % (n)
Male	47.5% (38)	62.5% (10)
Female	52.5% (42)	37.5% (6)

Age Group

	Indicated Threshold (n=80) % (n)	Did Not Indicate Threshold (n=16) % (n)
< 12.5 years	50% (40)	43.8% (7)
≥ 12.5 years	50% (40)	56.2% (9)

Appendix U

Proportion of Children who Did and Did Not Reach Point of Pain Tolerance

by Experimental Group, Child Gender, and Age Group

Group	Tolerance > 240 seconds (n=90) % (n)	Tolerance < 240 seconds (n=6) % (n)
Exaggerate	35.6% (32)	0% (0)
Minimize	31.1% (28)	66.7% (4)
Control	31.3% (30)	33.3% (2)

Child Gender

	Tolerance > 240 seconds (n=90) % (n)	Tolerance < 240 seconds (n=6) % (n)
Male	50.0% (45)	50.0% (3)
Female	50.0% (45)	50.0% (3)

Age Group

	Tolerance > 240 seconds (n=90) % (n)	Tolerance < 240 seconds (n=6) % (n)
< 12.5 years	47.8% (43)	66.7% (4)
≥ 12.5 years	52.2% (47)	33.3% (2)

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