

A MULTI-METHOD DYADIC INVESTIGATION OF CHILD AND PARENT PAIN
CATASTROPHIZING AND FAMILY FUNCTIONING IN CHILD PAIN

by

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For my grandmothers,
Joan Romeyn Birnie and Margaret Manson,
who paved a path for strong, curious, open-minded, passionate, and educated
women and mothers.

&

For my daughter Audrey,
for whom I hope this will be added pavement to that same path for you.

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ABSTRACT

Families play a critical role in children's pain. Theoretical and empirical work has explored individual child and parent, dyadic (parent-child interaction), and family-level factors; however, prior research has largely examined their influence on child pain in isolation from one another. This dissertation used a multi-informant multi-method design and dyadic analysis to advance our understanding of child and parent catastrophizing (Paper 1) and family functioning (Paper 2) in children's pain, as modeled using experimental pain. Participants included 171 community-based dyads comprised of one child 8-12 years old (89 girls) and one parent (135 mothers). Parent-child dyads completed two lab-based interaction tasks together in randomized counterbalanced order, including the child's completion of a cold pressor task (CPT) and a conflict discussion task. Children and parents reported on their trait and state pain catastrophizing about the child's pain, trait anxiety, situational distress, family functioning, and ratings of child pain intensity and unpleasantness. Child pain tolerance was also recorded. Micro-observational coding of parent and child verbalizations during the CPT captured parent attending, non-attending, and other talk, and child symptom complaints and other talk. Macro-observational coding during the conflict discussion task assessed aspects of family functioning. The actor-partner interdependence model and hierarchical multiple regressions explored intra- and inter-personal contributions to child pain. Paper 1: Results indicated that higher parent and child trait and/or state pain catastrophizing predicted their own ratings of greater child pain, with child state pain catastrophizing additionally influencing parent ratings. Parent and child state pain catastrophizing interacted significantly to influence child symptom complaints, including more child symptom complaints in dyads with low child and high parent pain catastrophizing. Paper 2: Results indicated no relation between family functioning and child pain outcomes. Poorer reported family functioning predicted greater child and parent trait anxiety and pain catastrophizing, and parent situational distress. Aspects of observed family functioning predicted child symptom complaints and other talk. The use of observational methodology and dyadic analysis revealed newly identified interpersonal influences of parent and family factors on children's verbal pain behaviours, and on parent perceptions of child pain and parent trait and state coping with child pain.

LIST OF ABBREVIATIONS AND SYMBOLS USED

<i>n</i>	Sample Size
<i>M</i>	Mean
<i>SD</i>	Standard Deviation
<i>r</i>	Pearson's Correlation Coefficient
<i>p</i>	P-value for Significance Testing
<i>ns</i>	Not Statistically Significant or P-value > .05
<i>t</i>	Student's t Value of the t Test for Testing Mean Differences
<i>F</i>	F distribution Value of the F Test for Testing Equality of Variances
<i>R</i>	Multiple Correlation Coefficient
<i>R</i> ²	Squared Multiple Correlation Coefficient
Δ	Change
β	Standardized Regression Coefficient or Beta Weight
SE	Standard Error
ICC	Intraclass Correlation
χ^2	Chi-square value
df	Degrees of freedom
CPT	Cold Pressor Task
APIM	Actor Partner Interdependence Model
PCS-C	Pain Catastrophizing Scale - Children
PCS-P	Pain Catastrophizing Scale - Parent
FPS-R	Faces Pain Scale – Revised
SCARED	Screen for Child Anxiety Related Emotional Disorders
BAI	Beck Anxiety Inventory
CAMPIS-R	Child-Adult Medical Procedure Interaction Scale - Revised
SCIFF	System for Coding Interactions and Family Functioning

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CHAPTER 1: INTRODUCTION

1.1 THE PROBLEM OF PEDIATRIC PAIN

Although pain management is recognized as a fundamental human right (Brennan, Carr & Cousins, 2007), children's pain has been grossly under recognized, with the relevance of pain management to children undergoing major medical procedures dismissed as recently as the 1980s (Schechter, 1989). Thankfully, the field of pediatric pain has made enormous advances since that time, revolutionizing how we assess and manage pain across childhood and adolescence (McGrath, 2011), resulting in international efforts to improve pain management for all children (Schechter, Finley, Bright, Laycock & Forgeron, 2010; Southall et al., 2000; World Health Organization, 2012; World Health Organization, 2015). However, despite these advances, pain remains a common experience for generally healthy and sick children (King et al., 2011; Stevens et al., 2011; van Dijk, McGrath, Pickett & VanDenKerkhof, 2006). Children can experience pain that is acute, typically resulting from illness, injury, or painful event, and time-limited before resolving with tissue healing and/or effective pain management (Stevens & Zempsky, 2014). Children can also experience pain that is chronic, which is pain without obvious biological value that persists passed the time of typical tissue healing, typically considered to be a period of at least 3 months. Acute fluctuations in chronic pain can occur and are referred to as recurrent pains, while other chronic pain can be more persistent and continuously present (Stevens & Zempsky, 2014). Acute and chronic pain can be very distressing for children and their families (Birnie, Boerner & Chambers, 2014), and can lead to negative long-term consequences if poorly managed, such as maintained or worsened pain and distress, quality of life, disability, or avoidance

of medical care later in life (Grunau, 2014; Hunfeld et al., 2001; Pagé, Huguet & Katz, 2014; Pate, Blount, Cohen & Smith, 1996; von Baeyer, Marche, Rocha & Salmon, 2004; Walker, Sherman, Bruehl, Garber & Smith, 2012).

A bibliometric analysis reviewing all peer-reviewed articles in pediatric pain from 1975-2010 revealed overall rapid growth in the field, although the examination of psychosocial factors, and more specifically parent and family factors, represented less than 10% of all publications in pediatric pain (Caes, 2014). Given the growing evidence for the importance of social factors in pain (Hadjistavropoulos et al., 2011; Mogil, 2015), the aggregation of pain in families (Higgins et al., 2015; Umberger, 2014), the role of childhood pain experiences in the development of pain in adulthood (Walker et al., 2012), and the significant impact of parents on children's acute and chronic pain (Birnie, Boerner, & Chambers, 2014), a further focus on the role of psychosocial factors and families in pediatric pain is warranted.

1.2 FAMILY CONTEXT OF PEDIATRIC PAIN

Although the role of families in the etiology, maintenance, and coping with pain have long been recognized (Turk, Flor & Rudy, 1987), theoretical models delineating their role in children's pain have only emerged over the past 10 years (Evans et al., 2008; Palermo & Chambers, 2005; Palermo, Valrie & Karlson, 2014). The publication of an integrative model of parent and family factors in pediatric chronic pain and disability provided the first formal framework from which to conceptualize their relation to children's pain (Palermo & Chambers, 2005). Specifically, the model sought to integrate two emerging areas of research, including the role of specific parental behaviours and the role of broader family factors, in children's pain. In the model, individual parent factors

(e.g., parenting style and behaviours) are situated with dyadic factors (e.g., parent-child interactions), which fall within family-level factors (e.g., family environment and functioning). Individual child factors (e.g., sex, coping, age) and child pain outcomes (e.g., functioning) interact with and are influenced by parent-, dyadic-, and family-level factors (Palermo & Chambers, 2005). A more recent model specifically outlined the influence of child-, parent-, and family-level factors in pediatric chronic pain within a developmental context across infancy, childhood, and adolescence (Palermo, Valrie, & Karlson, 2014). In doing so, this model suggested a bidirectional relation between normal developmental processes (e.g., physiological, psychological, social, and emotional) and how children, parents, and families perceive and respond to children's pain. A third model draws from clinical and experimental research to outline specific child and parent mechanisms implicated in the link between parental and child pain, identifying coping (e.g., catastrophizing), negative affect (e.g., anxiety), parent responses (e.g., solicitousness), and gender role socialization (Evans et al., 2008). Other models implicating parents as caregivers and observers of child pain communication allude only peripherally to the relevance of the broader family context (Craig, 2009; Goubert et al., 2005; Hadjistavropoulos et al., 2011).

What is clear across all of these models is that individual (child and parent), dyadic (parent-child), and family factors influence one another, with each playing a significant role in children's pain experiences. However, while conceptually informative, these models are limited by their lack of specificity in identifying relations between particular family variables and their direction of influence (Craig, 2009; Goubert et al., 2005; Hadjistavropoulos et al., 2011). As well, family-specific models also place an

emphasis on functional disability in the context of pediatric chronic pain (Palermo & Chambers, 2005; Palermo, Valrie & Karlson, 2014). This latter point is perhaps most problematic as a primary focus on functional disability limits the applicability of these models to pain that is not chronic, such as acute pain. The application of family models to acute pain need to consider the different primary treatment goal of minimized pain, as compared with the treatment goal of improved function, despite the potential presence of ongoing chronic pain. Acute pain experiences can be highly distressing for some children and their parents, but others are able to cope well, experience minimal distress, and report relatively low levels of pain. An increased understanding of the intrapersonal (within child or parent) and interpersonal (between child and parent) factors implicated in maladaptive versus adaptive parent and child coping can inform pain interventions.

1.3 PAIN CATASTROPHIZING IN PEDIATRIC PAIN

Of the many psychological constructs investigated in relation to pain, pain catastrophizing has emerged as an important individual factor given its strong associations with poorer biopsychosocial outcomes in clinical and experimental pain across the lifespan (Caes, Goubert, Sullivan & Chambers, 2013; Quartana, Campbell & Edwards, 2009). Pain catastrophizing is a maladaptive coping response that encompasses the tendency to ruminate about experienced or anticipated pain (rumination), magnify its negative impact (magnification), and feel helpless to manage it (helplessness) (Sullivan, Bishop & Pivik, 1995). Both genetic and environmental factors are implicated in the development and influence of pain catastrophizing on the pain experience (Trost et al., 2015). Measurement of pain catastrophizing has developed to capture its conceptualization as both a trait, or dispositional, variable and as a state, or situational,

variable (Quartana et al., 2009). Trait measures assess general tendencies to catastrophize in response to pain through cued recall to previous pain experiences and represent a relatively stable dispositional vulnerability to poor pain adaption; whereas state measures assess presence of catastrophic thoughts and coping related to a specific (typically acute) pain episode (Campbell et al., 2010; Sturgeon & Zautra, 2013a). The distinction between trait and state pain catastrophizing has received greater recognition thus far in empirical research with adult, as compared with pediatric, populations (Quartana et al., 2009).

Although earlier evidence for its consideration in child pain coping can be found (Reid, Gilbert & McGrath, 1998; Thastum, Zachariae, Scheler, Bjerring & Herlin, 1997), examination of children's pain catastrophizing has grown exponentially since the development of a pediatric version of the trait Pain Catastrophizing Scale (Crombez et al., 2003; Sullivan et al., 1995). A less commonly used state version of the scale has also been developed, assessing catastrophic thoughts specific to various experimental or clinical acute pain experiences (Boerner et al., 2015; Caes, Vervoort, Eccleston, Vandenhende & Goubert, 2011; Vervoort, Goubert & Crombez, 2009; Vervoort, Goubert, et al., 2011). Higher pain catastrophizing in children is associated with increased self-reported pain, fear, and distress, as well as verbal and nonverbal expressions of pain, pain protective behaviours, and pain-related disability (Boerner et al., 2015; Hermann, Hohmeister, Zohsel, Tuttas & Flor, 2008; Vervoort et al., 2008; Vervoort, Caes, Trost, et al., 2011; Vervoort, Eccleston, Goubert, Buysse & Crombez, 2010; Vervoort, Goubert, & Crombez, 2009; Vervoort, Goubert, Eccleston, et al., 2009; Vervoort, Goubert, et al., 2011; Vervoort, Huguet, Verhoeven & Goubert, 2011). Child trait pain catastrophizing and trait anxiety are positively correlated, and both have shown

distinct contributions in predicting greater child pain and disability over time (Tremblay & Sullivan, 2010; Vervoort et al., 2010). Parental responses to children's pain play a critical role in children's coping, and child pain catastrophizing has been associated with greater discouraging, solicitous, and distracting responses from parents (Hermann et al., 2008). A number of studies report child pain catastrophizing to moderate relations between parent responses and child pain outcomes, with generally stronger maladaptive associations for children who report higher pain catastrophizing (Vervoort, Caes, Trost, et al., 2011; Vervoort, Goubert, & Crombez, 2009; Williams, Blount & Walker, 2011). Child pain catastrophizing has also been found to mediate the relations between parental protective responses and child pain-related disability (Cunningham et al., 2014; Guite, McCue, Sherker, Sherry & Rose, 2011; Welkom, Hwang & Guite, 2013). Importantly, child pain catastrophizing appears to be implicated in children's treatment responses, with higher pain catastrophizing associated with decreased effectiveness of distraction for acute pain (Verhoeven, Goubert, Jaaniste, Van Ryckeghem & Crombez, 2012).

In addition to the child's own pain catastrophizing, the degree to which parents catastrophize about their child's pain is also important, and has been captured by similar trait and state versions of a Pain Catastrophizing Scale developed for parents (Boerner et al., 2015; Caes et al., 2011; Goubert, Eccleston, Vervoort, Jordan & Crombez, 2006; Vervoort, Goubert, et al., 2011). Higher parent pain catastrophizing is associated with greater parent reports of children's pain (Caes et al., 2011; Goubert, Vervoort, Cano & Crombez, 2009; Vervoort, Goubert, et al., 2011). Parents with higher levels of pain catastrophizing also report a greater tendency to want to stop their child from completing a painful task (Caes et al., 2011), place a greater emphasis on controlling pain over child

activity engagement (Caes, Vervoort, Eccleston & Goubert, 2012), as well as engage in more pain focused talk following a painful experience for the child (Caes, Vervoort, et al., 2014; Caes, Vervoort, Trost & Goubert, 2012). In children with chronic pain, higher parent pain catastrophizing was predictive of poorer school attendance and pain-related disability (Goubert et al., 2006; Logan, Simons & Carpino, 2012), greater perceived expressions of pain by children (Lynch-Jordan, Kashikar-Zuck, & Goldschneider, 2010) as well as greater parental protectiveness (Hechler et al., 2011). Parent pain catastrophizing was found to partially mediate the relation between child pain behaviour and parental protective responses (Langer, Romano, Mancl & Levy, 2014). Parent pain catastrophizing is related to higher levels of parent anxiety (Goubert et al., 2006), which is also implicated in maladaptive solicitous parent responses to child pain (Link & Fortier, 2015). Altogether, the above findings can be explained by the influence of pain catastrophizing on parents' emotional responses (Caes, Goubert, et al., 2014; Caes, Vervoort, et al., 2014; Goubert et al., 2005; Goubert, Vervoort, Sullivan, Verhoeven & Crombez, 2008), increased perceived threat of pain, and/or attentional focus on pain (Eccleston & Crombez, 1999; Hadjistavropoulos et al., 2011).

Research with adults suggests that the pain catastrophizing of important others (e.g., spouses) interacts with the individual's own level of pain catastrophizing to impact their pain experience (Gauthier, Thibault & Sullivan, 2011). Pediatric chronic pain research has followed suit, with research jointly examining the impact of child and parent pain catastrophizing on children's chronic pain and related outcomes. The poorest pain outcomes have been reported for dyads where both parents and children report high levels of pain catastrophizing (Williams, Logan, Sieberg & Simons, 2012), as well as

those with a child reporting high pain catastrophizing and a parent reporting low pain catastrophizing (Lynch-Jordan, Kashikar-Zuck, Szabova & Goldschneider, 2013).

Different findings could be explained by the grouping together of matched dyads in the latter study (i.e., parent-child dyads where both reported high or both reported low pain catastrophizing). These findings are often discussed within the communal coping model of pain, which suggests that individuals with high levels of pain catastrophizing act in ways intended to elicit support from others, thereby increasing the likelihood that their pain and distress will be managed in an interpersonal context (Sullivan et al., 1995). The remaining studies suggest a primary role for child pain catastrophizing, reporting that any influence of parent pain catastrophizing or parent behaviours on children's pain is better accounted for by the influence of child pain catastrophizing on child pain, disability, and related outcomes (Cunningham et al., 2014; Pielech et al., 2014; Simons, Smith, Kaczynski & Basch, 2015; Vowles, Cohen, McCracken & Eccleston, 2010; Wilson, Moss, Palermo & Fales, 2014).

Relatively few studies have concurrently examined child and parent pain catastrophizing in children experiencing pain that is not chronic in nature (Esteve, Marquina-Aponte & Ramírez-Maestre, 2014; Noel, Rabbitts, Tai & Palermo, 2015; Vervoort, Goubert, et al., 2011; Vervoort, Trost & Van Ryckeghem, 2013). While most studies with pediatric chronic pain report significant associations between total scores of child and parent trait pain catastrophizing (Cunningham et al., 2014; Lynch-Jordan et al., 2013; Pielech et al., 2014; Simons et al., 2015; Vowles et al., 2010; Welkom et al., 2013), studies of children's post-surgical (Noel et al., 2015) or experimental (Vervoort et al., 2013) pain do not. Only one study that assessed child and parent trait pain catastrophizing

pre-operatively reported significant correlations between them, as well as with children's and parents' own ratings of the child's post-operative pain (Esteve et al., 2014). In that study, unique relations were reported between child and parent pain catastrophizing and parent behaviours, with child pain catastrophizing predicting greater parent discouragement and parent pain catastrophizing predicting greater parent solicitousness following pediatric surgery (Esteve et al., 2014). Similar research on pediatric postoperative pain identified a central role of parent trait pain catastrophizing in both children's and parents' pain memories, with child trait pain catastrophizing implicated only indirectly (Noel et al., 2015). In that study, only the helplessness aspects of child and parent trait pain catastrophizing were significantly related, with no other associations between child or parent trait pain catastrophizing (Noel et al., 2015). An important role for aspects of both child and parent pain catastrophizing is shown in children's selective attention to others' pain and avoidance of pain experienced during a cold pressor task (Vervoort et al., 2013). More specifically, children reporting greater pain magnification or who had parents reporting greater rumination or magnification showed greater attentional avoidance of pain, which interacted to decrease children's pain tolerance (Vervoort et al., 2013). In this study, only the magnification aspect of child trait pain catastrophizing showed significant relations with the rumination and helplessness aspects of parent trait pain catastrophizing. With regards to clinical acute pain, only one study found that state pain catastrophizing of children with diabetes and their mothers regarding a finger prick was not significantly related (Vervoort, Goubert, et al., 2011). Taken altogether, these studies suggest the important role of both child and parent catastrophizing about the child's pain. They are limited by their minimal consideration of

child and parent state pain catastrophizing in children's pain, the lack of examinations of observed parent and child behaviours during pain, and the limited use of dyadic data analysis, identifying a need for more research in this area.

1.4 PARENT-CHILD INTERACTIONS IN PEDIATRIC PAIN

Observations of parents and children during children's pain have contributed critically to our understanding of dyadic interactions in children's pain experience. What is known about parent-child interactions during child pain has built heavily on studies conducted by Blount and colleagues in the late 1980s and early 1990s who developed an observational coding system to capture interactions between adults and children during medical procedures, known as the Child-Adult Medical Procedure Interaction Scale (CAMPIS) (Blount et al., 1989). Use of observation to examine parent and child behaviours offered increased scientific rigour and validity to this area of research as parents are generally highly inaccurate in self-reporting their behaviours during children's pain (Cohen, Manimala & Blount, 2000). Several iterations and modifications of the original CAMPIS coding scheme (CAMPIS-Revised & CAMPIS-Short Form) (Blount, Bunke, Cohen & Forbes, 2001; Blount et al., 1997) have been applied to observe parent-child interactions with generally healthy children and children with chronic pain or other chronic illness (e.g., cancer) undergoing various experimental or clinical acute pain (e.g., needle procedures) (Caes, Vervoort, et al., 2014; Caes, Vervoort, Trost, et al., 2012; Chambers, Craig & Bennett, 2002; Dahlquist, Power & Carlson, 1995; McMurtry, Chambers, McGrath & Asp, 2010; Moon, Chambers & McGrath, 2011; Reid, McGrath & Lang, 2005; Spagrud et al., 2008; Taylor, Sellick & Greenwood, 2011; Vervoort, Caes, Trost, et al., 2011; Walker et al., 2006; Williams et al., 2011). Many of these

investigations have focused predominantly on parent responses during children's acute pain, and although slight differences between studies have been reported, parent behaviours can generally be grouped according to relations with either better or worse child coping, pain, and distress. Parent responses typically associated with increased child pain and distress, and decreased child coping, include reassurance, apologies, empathy, giving control to the child, and criticism. Combinations of these behaviours have been referred to as pain promoting, distress promoting, symptom-related talk, and/or pain attending talk. Parent responses typically associated with increased child coping, include nonprocedural talk (e.g., distraction), commands to use coping strategies, and humour. Combinations of these behaviours have been referred to as pain reducing, coping promoting, non-symptom-related talk, and/or non-attending talk.

Chambers and colleagues (2002) published a seminal study in this area, as its experimental manipulation of mothers' behaviours during children's pain supported a causal link between parent responses and child pain outcomes. More specifically, compared to generally healthy children whose mothers received no instruction, children whose mothers' were instructed to engage in pain-promoting responses reported increased pain intensity during a cold pressor task, while children whose mothers were instructed to engage in pain-reducing responses reported decreased pain intensity. However, the relation between maternal behaviour and child response was only demonstrated when mothers interacted with their daughters, not their sons. These associations between parent responses and child pain outcomes have since been observed with both mothers and fathers (Moon et al., 2011). Using a similar manipulation of parents' responses as Chambers and colleagues (2002), a subsequent study found that

healthy children and those with chronic functional abdominal pain engaged in almost twice as many symptom complaints during experimentally induced abdominal discomfort (i.e., the water load task) when their parents attended to, sympathized, and apologized for the child's pain versus distracted them away from the pain (Walker et al., 2006). The negative impact of parental attention was particularly noticeable for girls with chronic pain.

Sequential analyses of parent-child interactions have revealed more nuanced bidirectional influences between parent and child responses during children's pain. Two patterns of parent-child interaction appear consistently across several studies of children undergoing needle-related procedures (Blount et al., 1989; Spagrud et al., 2008; Taylor et al., 2011). The adaptive pattern is shown when child coping behaviours are more likely to be both preceded by and followed by parent coping-promoting behaviours (e.g., parental distraction, humor, and commands to cope) as compared with other parent behaviours. In contrast, a more maladaptive pattern is shown when child distress is typically preceded and followed most notably by parental reassurance, but also other distress-promoting behaviours (e.g., parental apology, criticism, and giving control to child) (Blount et al., 1989; Spagrud et al., 2008; Taylor et al., 2011). Parental reassurance can occur repeatedly following child distress (Blount et al., 1989), but has also been found to precede some child coping behaviours in addition to child distress (Taylor et al., 2011). Additional research with both healthy children and those with chronic pain, and their parents, also showed a cascading negative consequence from maladaptive parent-child interactions (Reid et al., 2005). In this study, children were less likely to maintain engagement in a mildly painful experimental exercise task when discouraging comments from parents

followed children's negative statements about pain or coping. Parent-child interactions are mutually regulated processes and these findings suggest that behaviours of both members of the dyad can serve to maintain the interaction in either adaptive or maladaptive ways (Blount et al., 1989; Spagrud et al., 2008; Taylor et al., 2011).

Research has begun to explore individual characteristics of the parent or child that identify parent-child dyads who may be at particular risk for maladaptive interactional patterns and subsequently, increased child pain and distress. Child factors of pain threat appraisal and pain catastrophizing have been implicated in parent-child interactions during and following child pain (Vervoort, Caes, Trost, et al., 2011; Williams et al., 2011). Child pain catastrophizing has been shown to moderate the association between parent symptom-related talk and child symptom complaints in children with functional abdominal pain undergoing an experimental pain task, such that the relation was only significant for children reporting high levels of pain catastrophizing (Williams et al., 2011). This same study found that parent non-symptom-related talk was only associated with fewer child symptom complaints among children who reported a high tendency to perceive their functional abdominal pain as threatening. A subsequent study observing interactions between healthy children and their parents following the cold pressor task reported the impact of parent non-pain-attending talk to be most influential for children with high pain catastrophizing, such that the relation between higher child pain catastrophizing and greater child self-reported pain was only found when high levels of parent non-pain-attending talk occurred (Vervoort, Caes, Trost, et al., 2011).

Similar to child results, parents' tendency to catastrophize about their child's pain has also been implicated in parent-child interactions following child pain; however its

impact may be moderated by the degree of threatening information provided about the pain experience and levels of parental situational distress (Caes, Vervoort, et al., 2014; Caes, Vervoort, Trost, et al., 2012). Specifically, parents with high levels of pain catastrophizing engaged in less pain-attending talk than parents with low levels of pain catastrophizing following the child's exposure to repeated experimental heat pain, but only when they received neutral (versus high threat) information about the pain task (Caes, Vervoort, Trost, et al., 2012). Parents with high levels of pain catastrophizing appeared particularly influenced by contextual information about the pain to which their child was exposed, with parents with high catastrophizing who received the high threat information engaging in greater pain-attending talk as compared with those who received neutral information about the pain task. Parents who received threatening information about the experimental heat pain task engaged in greater pain attending talk regardless of level of parent pain catastrophizing (Caes, Vervoort, Trost, et al., 2012). Additional observations of parent-child interactions following lumbar punctures and bone marrow aspirations for children with cancer, have shown nuances in parental pain catastrophizing based on parent distress and phase of the procedure, as well as child age (Caes, Vervoort, et al., 2014). Greater levels of parent pain catastrophizing were associated with less parent pain-attending talk with children prior to the needle procedure, but only for younger children. Increased levels of parent situational distress mediated the influence of high parent pain catastrophizing on greater verbal and nonverbal pain-attending parent behaviours following the child's painful procedure (Caes, Vervoort, et al., 2014). Parent trait anxiety has also shown associations with parent behaviours during child pain, including increased parental agitation behaviours and decreased reassurance (Dahlquist,

Power, Cox & Fernbach, 1994).

Although investigated to a much lesser extent, associations between parents' communication style (as opposed to specific responses) and child distress during medical procedures has also been examined. In a study of children with cancer undergoing port access and lumbar punctures, four patterns of parents' communication style with their children were identified: normalizing, supportive, invalidating, and distancing (Cline et al., 2006). Normalizing and supportive were the most common parental communication styles prior to the procedure (46% and 31% of parents, respectively), with supportive communication being most common during and following the procedure (45-50% of parents). Despite being the least common (~10% of parents across all procedure phases), parental invalidation of the child's experience was associated with significantly greater child pain and distress as compared with all other parental communication patterns. Furthermore, parental invalidation occurred at greater frequency during less invasive procedures (Cline et al., 2006). No formal comparison to the CAMPIS categories of parent behaviours were made, although the authors' in this study suggested some overlap in that normalizing parental communication can include distraction, supportive parental communication can include empathic or comforting responses, and parental invalidation can include criticism and frustration; however, the authors indicated that these comparisons are overly simplistic and that the identified parental communication patterns are conceptually distinct (Cline et al., 2006).

Taken together, previous research suggests value in observing parent-child interactions during child pain, looking at both specific content of parent and child behaviours, as well as the relevance of non-pain parent-child communication and

consideration of the broader social context within which these interactions occur.

1.5 FAMILY FUNCTIONING AND PEDIATRIC PAIN

The family environment has been recognized as an important context within which children learn to cope, and can protect against the negative consequences of stressors (Kliewer, Fearnow & Miller, 1996; Kliewer, Sandler & Wolchik, 1994; Zimmer-Gembeck & Locke, 2007). Similarly applied to child pain, family functioning characterizes the broader context within which parent-child interactions during pain occur (Palermo & Chambers, 2005). Family functioning refers to the structural and social properties of the family environment, with family interactions and relationships characterized by each family member's roles (family organization), their involvement and closeness (cohesiveness), the clarity and straightforwardness of their communication, their expression of feelings and conflict (family affective environment), and their ability to problem-solve (Alderfer et al., 2008). Families with healthy functioning are reported to communicate clearly, have well-defined roles, are cohesive, and have well-regulated affect, whereas poorer functioning families are reported as chaotic, have high levels of conflict, and become dysregulated in response to stress (Alderfer et al., 2008).

Despite theoretical recognition of the importance of the family to children's pain experiences (Evans et al., 2008; Palermo & Chambers, 2005; Palermo, Valrie, & Karlson, 2014), relatively few studies have empirically studied family functioning in relation to children's pain. A systematic review of families of children and adolescents with chronic pain indicated that studies consistently report poorer family functioning amongst families with pediatric chronic pain as compared with healthy comparison families, and associations with greater pain-related disability (Lewandowski, Palermo, Stinson,

Handley & Chambers, 2010); however, cluster analyses of children with chronic pain suggests that not all of families of children with chronic pain experience significant family dysfunction (Scharff et al., 2005). Although it is unclear whether worse family functioning is a precursor to or consequence of pediatric chronic pain, recent work has identified maladaptive interpersonal parent-child processes that contribute to poorer functioning in these families. One such example is ‘miscarried helping’ or an inadvertent negative transactional process resulting from parents’ attempts to help their child, which predicted poorer reports of family functioning by adolescents with chronic pain and their parents (Fales, Essner, Harris & Palermo, 2014). Family functioning has demonstrated relations with parent beliefs about child pain, with associations between poorer family functioning and greater parenting stress, greater parental worry about the child’s emotional wellbeing and behaviour, greater sense of responsibility for the child’s chronic pain, and belief that emotions and stress are implicated in pain (Guite, Logan, McCue, Sherry & Rose, 2009). In validating a measure of parent health-related quality of life and family functioning, one study reported associations between lower child and parent pain catastrophizing and healthier family functioning as reported by mothers and fathers of adolescents with chronic pain (Jastrowski Mano, Khan, Ladwig & Weisman, 2011). Poorer family function is also related to greater anxiety amongst children with chronic pain (Gauntlett-Gilbert & Eccleston, 2007), a finding which mirrors research reporting poorer functioning in families with children with high levels of anxiety (Bögels & Brechman-Toussaint, 2006). Findings remain equivocal regarding family functioning and pain intensity, with some studies reporting associations between poorer family functioning and increased pain, and others findings associations between aspects of

healthier family functioning and increased pain (Lewandowski et al., 2010). Taken together, it appears that both greater conflict, as well as very high levels of closeness and dependence, in parent-child relationships contributes to poorer child pain and disability (Logan & Scharff, 2005; Logan, Guite, Sherry & Rose, 2006; Schanberg, Keefe, Lefebvre, Kredich & Gil, 1998). To our knowledge, no studies have examined the role of family functioning in child pain that is not chronic in nature. Taken together, this research suggests that characteristics of the family environment are relevant to children's pain experiences; however, they provide limited or conflicting empirical evidence for the role of the family to child pain beyond pain-related disability. More research is needed investigating the role of family functioning in parent and child coping, parent-child behaviours, and perceptions of child pain. Furthermore, the research to date is critically limited by its reliance on self-report questionnaire assessment of family functioning (Lewandowski et al., 2010), which offers a limited understanding of the family (Holmbeck, Li, Schurman, Friedman & Coakley, 2002).

1.6 MEASUREMENT OF FAMILY FACTORS

In order for research to more fully understand the role of the family in children's pain, it is important to consider the methods by which family processes are assessed. A multitude of self-report and observational measures exist, capturing a range from specific behaviours to global judgments of dyadic and family-level processes (Alderfer et al., 2008; Ginsburg, Siqueland, Masia-Warner & Hedtke, 2004; Kerig & Lindahl, 2001). Data obtained from a variety of sources (e.g., parent and child) and approaches (e.g., questionnaire and observation) are referred to as multi-informant multi-method research designs, and offer high scientific rigour and value to the study of families (Holmbeck et

al., 2002). As opposed to more rigorous multi-method designs, single-source single-method studies are more common, likely given the high resource burden of multi-informant multi-methods research (Holmbeck et al., 2002). However, single-source designs are inherently limited by their dependence on a single member of the family, whose reports reflect only their perspective of the family (Lewandowski et al., 2010). This is problematic as informants often show low-to-moderate agreement with one another, and with observational assessment (Alderfer et al., 2008; Holmbeck et al., 2002; Schanberg et al., 1998); furthermore, observational assessment is thought to be less biased (Ginsburg et al., 2004) and typically results in larger effect sizes as compared to self-report when assessing family processes (McLeod, Wood & Weisz, 2007; Pinquart, 2014). An additional benefit of observational assessment is that it is methodologically similar to clinical observation, enhancing natural identification of specific behaviours that can be targeted for intervention (Kerig & Lindahl, 2001).

Special considerations arise for handling multi-informant multi-method data including decisions to aggregate, examine discrepancies, or maintain disaggregation of data across sources and methods (Holmbeck et al., 2002). In family research, disaggregated data makes it possible to test for differential effects based on child versus parent perceptions, and from observed behaviours as captured during parent-child interactions. Selection of appropriate data analysis must also consider the non-independence of data derived from families, such as parents and children. This is important as ignoring non-independence can increase the likelihood of incorrect rejection of a true null hypothesis (Type I error) or failure to reject a false null hypothesis (Type II error) (Kenny, Kashy & Cook, 2006). Dyadic data analysis accounts for these issues and

is ideal for investigating interpersonal effects in parent-child dyads (Kenny, 2011). The Actor-Partner Interdependence Model (APIM) has emerged as a valuable multilevel modeling statistical approach for testing intra- and inter-personal influences in dyads, referred to as actor and partner effects, respectively (Cook & Kenny, 2005; Kenny et al., 2006). In order to estimate these effects, APIM requires that comparable predictor and outcomes variables are available from both members of each dyad. Although APIM has been recommended for dyadic data analysis, it is relatively innovative in its application to studying parent-child dyads (Driscoll, Schatschneider, McGinnity & Modi, 2012; Lunkenheimer & Leerkes, 2015), particularly in pediatric pain (Fales et al., 2014). Application of multi-informant multi-method research design and dyadic data analysis to examining families in children's pain is timely and builds on existing research (Lewandowski et al., 2010).

1.7 MEASUREMENT OF PEDIATRIC PAIN

When considering use of multi-source research designs in pediatric pain, it is important to remember that pain is inherently a subjective experience, implying the importance of obtaining self-report of pain intensity and its associated emotions (e.g., unpleasantness, distress) whenever possible (McGrath et al., 2008; Merskey & Bogduk, 1994). Children as young as 3 or 4 years old can provide ratings of their pain experience (von Baeyer, Uman, Chambers & Gouthro, 2011), with corresponding recommended self-report measures based on child age (McGrath et al., 2008; Stinson, Kavanagh, Yamada, Gill & Stevens, 2006). Despite being often relied on as proxy reporters of their children's pain, parents tend to inaccurately estimate their children's pain experience (Chambers, Giesbrecht, Craig, Bennett & Huntsman, 1999; Chambers, Reid, Craig,

McGrath & Finley, 1998). Importantly, individual child and parent factors, as well as the social context, appear to influence pain ratings provided by children and their parents (Craig, 2009; Hadjistavropoulos & Craig, 2002). For example, lower pain catastrophizing in children (Vervoort, Goubert, & Crombez, 2009) and higher pain catastrophizing in parents (Goubert et al., 2009) contributes to greater similarity in parent and child ratings of child pain intensity. It is relevant to understand the influences on parent ratings of child pain, as their proxy reports can be used to inform decisions regarding their child's pain management.

The introduction of experimental pain to pediatric pain research in the early 1980s offered the opportunity to examine research questions that were not feasible or were very difficult to address in the real world (Feuerstein, Barr, Francoeur, Houle & Rafman, 1982). Lab-based paradigms involve temporary induction of pain using a variety of pain-inducing stimuli such as cold, heat, or pressure and have been applied to improve knowledge regarding biopsychosocial factors implicated in children's acute and chronic pain (Birnie, Caes, Wilson, Williams & Chambers, 2014). Major advantages of experimental pain include greater control over the environment and standardization of pain stimuli, facilitating the examination of individual and environmental factors and maximizing the likelihood that behaviours of interest will be observed (Birnie, Caes, et al., 2014). Thus, experimental induction of pain provides a pain paradigm with high internal validity. Given these strengths, the use of experimental methods to better understand the mechanisms and predictions of pain report and pain responding by children and parents offers utility in the study of clinical pain (Edens & Gil, 1995). However, experimental pain is not without its criticisms and limitations. Most notably are

ethical concerns about the risks and unnecessary induction of pain in children without direct benefit (Birnie, Noel, Chambers, von Baeyer & Fernandez, 2011) and the limited information about generalizability of findings from these studies outside of the lab (Birnie, Caes, et al., 2014; Edens & Gil, 1995). The cold pressor task (CPT) is the most widely used experimental pain task with children, with typical measured outcomes of pain intensity, unpleasantness, and tolerance (Birnie, Petter, Boerner, Noel & Chambers, 2012). Particular benefits of the CPT are its demonstrated ethical acceptability to children and parents (Birnie et al., 2011), availability of recommended task guidelines (von Baeyer, Piira, Chambers, Trapanotto & Zeltzer, 2005), and its suitability for examining parent-child interactions given the several minute duration of the task (Birnie, Caes, et al., 2014). Recent research also suggests that children with high pain catastrophizing perceive the CPT to be more akin to an acute clinical pain experience (e.g., a needle) than children with low pain catastrophizing (Boerner et al., 2015). The use of experimental pain in pediatric pain research is likely to grow in the coming years. This is likely to happen given its ease, as compared with clinical pain, for exploring biopsychosocial mechanisms explaining differences between clinical and healthy samples, identifying risk factors for altered pain responses or the development of chronic pain, and for the development and training in use of pain coping strategies (Edens & Gil, 1995; Wilson, Holley & Palermo, 2013). Thus, experimental pain will continue to play an important role toward ensuring that children benefit from improved understanding of pain through their inclusion in such research (Birnie, Caes, et al., 2014).

1.8 INTRODUCTION TO DISSERTATION PAPERS

The primary goal of this dissertation was to address knowledge gaps in the

relation of individual child and parent, dyadic parent-child interaction, and family-level factors in children's pain. It was specifically designed to improve upon previous research in the area by employing multi-informant multi-method assessment and dyadic data analytic techniques (i.e., the actor-partner interdependence model). This dissertation employed the CPT as an experimental pain paradigm to explore the role of child and parent state and trait pain catastrophizing, and general family functioning, in parent-child interactions during child pain and ratings of child pain outcomes. To accomplish this, data derived from a single larger study was used to address two major research objectives, which are presented as two separate papers (e.g., chapters) in this dissertation. Additional relevant background information is provided within each of those chapters.

As part of this study, children and parents attended one lab visit during which they completed self-report measures of trait anxiety, trait pain catastrophizing about the child's pain, and general family functioning. Parent-child dyads participated in two lab-based interactions tasks in randomized order, including the child's completion of the CPT with the parent present, and the dyad's completion of a conflict discussion task. Existing micro- and macro- observational coding systems were used to capture parent-child interactions during the CPT and general family functioning during the conflict discussion task, respectively. Children and parents rated state pain catastrophizing about the child's pain, situational distress, and child pain intensity and unpleasantness during the CPT; child pain tolerance was also recorded.

The first paper reports on the investigation of intra- and inter-personal effects of child and parent state and trait pain catastrophizing on (a) child pain outcomes, and (b) observed parent-child interactions during child pain. Intrapersonal effects were expected

with greater child pain catastrophizing predicting greater child symptom complaints and poorer self-reported pain ratings, and greater parent pain catastrophizing predicting greater pain-attending talk by parents and parent report of poorer child pain (Esteve et al., 2014; Goubert et al., 2009; Hermann et al., 2008; Vervoort, Caes, Trost, et al., 2011; , Vervoort et al., 2008; Vervoort, Goubert, & Crombez, 2009; Vervoort, Goubert, Eccleston, et al., 2009; Vervoort, Goubert, et al., 2011). Interpersonal effects were expected between child pain catastrophizing and parent behaviours (Esteve et al., 2014; Simons et al., 2015). Overall, poorer child pain outcomes were expected when both child and parent pain catastrophizing were high, as compared to when one reported high and the other reported low pain catastrophizing, or when both reported low pain catastrophizing (Goubert & Simons, 2014; Williams, Logan, et al., 2012).

The second paper reports on the investigation of the role of self-reported and observed general family functioning in (a) ratings of child pain and child pain tolerance, (b) observed parent-child interactions during child pain, (c) parent and child dispositional vulnerability factors of trait anxiety and trait pain catastrophizing to poor pain coping, and (d) parent and child situational coping of state pain catastrophizing and situational distress. It was expected that healthier family functioning would be associated with better reported child pain outcomes, more adaptive parent-child interactions during pain, lower trait anxiety and trait pain catastrophizing, and lower state pain catastrophizing and situational distress (Ashby Wills, Blechman & McNamara, 1996; Bögels & Brechman-Toussaint, 2006; Jastrowski Mano et al., 2011; Kliewer et al., 1994; Lewandowski et al., 2010; Zimmer-Gembeck & Locke, 2007).

**CHAPTER 2:
DYADIC ANALYSIS OF CHILD AND PARENT TRAIT AND STATE PAIN
CATASTROPHIZING IN CHILDREN’S PAIN**

The manuscript based on this study is presented below. Readers are advised that Kathryn Birnie, under the supervision of Dr. Christine Chambers, developed the research questions, methodology, and analytical approach for this research. She was responsible for developing the study protocol and proposal, applying for and obtaining funding to support this research, applying for and obtaining research ethics approval, and overseeing all data collection and coding. She conducted all of the background research and literature review for this manuscript and was responsible for all aspects of the writing process. Prior to submission, she received editorial feedback from the study’s co-authors/co-investigators (i.e., dissertation committee members). The manuscript has been submitted to the journal *Pain*. The full reference for this manuscript is:

Birnie, K.A., Chambers, C.T., Chorney, J., Fernandez, C.V., & McGrath, P.J. (submitted). Dyadic investigation of child and parent trait and state pain catastrophizing in children’s pain. *Pain*.

2.1 ABSTRACT

Explored separately, child and parent catastrophic thoughts about child pain show robust negative relations with child pain. The objective of this study was to conduct a dyadic analysis to elucidate intra- and inter-personal influences of child and parent pain catastrophizing on observed behaviours and perceptions of child pain. A community sample of 171 dyads including a child aged 8-12 years (89 girls) and parent (135 mothers) rated pain catastrophizing (PCS-C and PCS-P trait and state versions), and child pain intensity and unpleasantness following a cold pressor task (CPT). Child pain tolerance was also assessed. Parent-child interactions during the CPT were coded for parent attending, non-attending, and other talk, and child symptom complaints and other talk. Data was analyzed using the actor-partner interdependence model and hierarchical multiple regressions. Children reporting higher state pain catastrophizing had greater symptom complaints regardless of level of parent state pain catastrophizing. Children reporting low state pain catastrophizing had similar high levels of symptom complaints, but only when parents reported high state pain catastrophizing. Higher child and parent state and/or trait pain catastrophizing predicted their own ratings of higher child pain intensity and unpleasantness, with child state pain catastrophizing additionally predicting parent ratings. Higher pain tolerance was predicted by older child age and lower child state pain catastrophizing. These newly identified interpersonal effects highlight the relevance of the social context to children's expressions of pain and when interpreting parent perceptions of child pain. Both child and parent pain catastrophizing should be considered when managing child pain.

2.2 INTRODUCTION

Pain catastrophizing is associated with maladaptive emotional, behavioural, physiological, and interpersonal responses to chronic, acute, and experimental pain across the lifespan (Quartana, Campbell & Edwards, 2009; Sullivan, 2012). Despite theoretical recognition of the unique contributions and interdependence of child and parent coping to children's pain (Palermo & Chambers, 2005; Palermo, Valrie & Karlson, 2014), empirical work has largely studied child and parent catastrophic thoughts about child pain in isolation from one another. When studied separately, higher child pain catastrophizing has been associated with increased self-reported pain, fear, and distress, as well as greater pain expressions, protective behaviours, and disability (Boerner et al., 2015; Hermann, Hohmeister, Zohsel, Tuttas & Flor, 2008; Vervoort, Caes, Trost, et al., 2011; Vervoort et al., 2008; Vervoort, Eccleston, Goubert, Buysse & Crombez, 2010; Vervoort, Goubert & Crombez, 2009; Vervoort, Goubert, Eccleston, et al., 2009; Vervoort, Goubert, et al., 2011). Interpersonal associations of child pain catastrophizing include greater discouraging, solicitous, and protective responses from parents (Cunningham et al., 2014; Guite, McCue, Sherker, Sherry & Rose, 2011; Hermann et al., 2008; Vervoort, Huguet, Verhoeven & Goubert, 2011; Welkom, Hwang & Guite, 2013). These parent behaviours are related to poorer child pain outcomes, particularly for children with higher pain catastrophizing (Cunningham et al., 2014; Guite et al., 2011; Vervoort, Caes, Trost, et al., 2011; Vervoort, Goubert, & Crombez, 2009; Welkom et al., 2013; Williams, Blount & Walker, 2011). Greater pain catastrophizing by parents is also associated with poorer child pain and functioning (Goubert, Eccleston, Vervoort, Jordan & Crombez, 2006; Goubert, Vervoort, Cano & Crombez, 2009; Logan, Simons, & Carpino, 2012; Vervoort,

Goubert, et al., 2011) through its influence on parents' emotional and behavioural responses (Caes, Goubert. et al., 2014; Caes, Vervoort, et al., 2014; Caes, Vervoort, Eccleston & Goubert, 2012; Caes, Vervoort, Eccleston, Vandenhende & Goubert, 2011; Caes, Vervoort, Trost & Goubert, 2012; Goubert et al., 2005; Goubert, Vervoort, Sullivan, Verhoeven & Crombez, 2008; Hechler et al., 2011; Langer, Romano, Mancl & Levy, 2014).

Several studies have concurrently examined child and parent pain catastrophizing (Cunningham et al., 2014; Esteve, Marquina-Aponte & Ramírez-Maestre, 2014; Lynch-Jordan, Kashikar-Zuck, Szabova & Goldschneider, 2013; Noel, Rabbitts, Tai & Palermo, 2015; Pielech et al., 2014; Simons, Smith, Kaczynski & Basch, 2015; Vervoort, Goubert, et al., 2011; Vervoort, Trost & Van Ryckeghem, 2013; Vowles, Cohen, McCracken & Eccleston, 2010; Welkom et al., 2013; Williams, Logan, Sieberg & Simons, 2012; Wilson, Moss, Palermo & Fales, 2014). Poorer child pain outcomes have been reported in dyads with both high pain catastrophizing children with chronic pain and their parents, as compared with discordant dyads (i.e., high parent-low child or low parent-high child) or dyads with low pain catastrophizing children and parents (Williams, Logan, et al., 2012). Poorer child chronic pain and coping have also been found for dyads including a child with high pain catastrophizing and parent with low pain catastrophizing as compared to concordant dyads; although high-high and low-low dyads were combined in the concordant group (Lynch-Jordan et al., 2013). Most studies find significant associations between child and parent pain catastrophizing (Cunningham et al., 2014; Esteve et al., 2014; Lynch-Jordan et al., 2013; Pielech et al., 2014; Simons et al., 2015; Vowles et al., 2010; Welkom et al., 2013), with the influence of parent pain catastrophizing on child

pain and coping occurring via the child's pain catastrophizing (Cunningham et al., 2014; Pielech et al., 2014; Simons et al., 2015; Vowles et al., 2010; Wilson et al., 2014).

However, several studies examining pediatric post-surgical (Esteve et al., 2014; Noel et al., 2015) or experimental pain (Vervoort et al., 2013) report a direct contribution of parent pain catastrophizing to children's attentional avoidance to pain and pain tolerance, parent behaviours, and parent and child pain memories, in addition to the influence of child pain catastrophizing.

Existing research on child and parent pain catastrophizing lacks multilevel modeling designed to investigate interpersonal influences and address the non-independence of dyadic data, which can bias significance tests if ignored (Kenny, Kashy & Cook, 2006). Additional limitations include a predominant reliance on questionnaire measurement of parent behaviours, as well as a focus on dispositional tendencies to catastrophize about child pain, known as trait pain catastrophizing (Crombez et al., 2003; Goubert et al., 2006). In contrast, state pain catastrophizing focuses on catastrophic thoughts about specific (typically acute) pain experiences, and appears more strongly implicated in experimental pain and acute fluctuations in chronic pain (Campbell et al., 2010; Sturgeon & Zautra, 2013b), potentially representing an effective treatment target (Terry, Thompson & Rhudy, 2015).

This study is the first to examine dyadic influences of child and parent trait and state pain catastrophizing on observed parent-child interactions during child pain, and ratings of child pain. It was expected that higher pain catastrophizing by children and parents would be related to their own engagement in pain-focused talk and higher reports of child pain (Esteve et al., 2014; Goubert et al., 2009; Hermann et al., 2008; Vervoort,

Caes, Trost, et al., 2011; Vervoort et al., 2008; Vervoort, Goubert, & Crombez, 2009; Vervoort, Goubert, Eccleston, et al., 2009; Vervoort, Goubert, et al., 2011). Child pain catastrophizing was also expected to predict parent behaviours (Esteve et al., 2014; Simons et al., 2015). Poorer pain outcomes were expected when pain catastrophizing by children and parents was high (Goubert & Simons, 2014; Williams, Logan, et al., 2012).

2.3 METHODS

Data reported in this paper was collected as part of a larger study examining two main research questions that are presented in separate papers. The current paper examines the role of child and parent pain catastrophizing in parent-child interactions during a cold pressor task, and subsequent ratings of child pain. The other paper examines the role of family functioning in children's pain (Birnie, Chambers, Chorney, Fernandez & McGrath, 2015a). The IWK Health Centre research ethics board approved the study.

2.3.1 Participants

A total of 171 parent-child dyads participated in the study. Eligible participants were recruited from the community and included dyads comprised of one child (8-12 years old) and a parent. Based on parent report, children were excluded from the study if they were unable to speak, write, or read sufficiently to answer written questions or converse in English, if they had uncorrected vision or hearing impairments, if they had a developmental delay or disability, if there was any contraindication to participating in the cold pressor task (von Baeyer, Piira, Chambers, Trapanotto & Zeltzer, 2005), or if they had previously completed the cold pressor task. Parents were excluded if they were unable to speak, write, or read sufficiently to answer written questions or converse in English, or if they had previously completed the cold pressor task. Twenty parent-child

dyads were excluded for not meeting eligibility criteria. An additional six participating dyads were excluded as they did not speak in English for at least half of the parent-child interaction during the cold pressor task ($n=4$), the interaction was accidentally not recorded ($n=1$), or they withdrew from the study early ($n=1$).

Participating children had a mean age of 10.03 years ($SD=1.38$) and 89 (52.0%) were female. As reported by parents, most children were White ($n=142$; 83.0%), followed by mixed race ($n=17$; 9.9%), Asian ($n=5$; 2.9%), First Nations/Aboriginal ($n=4$; 2.3%), Arab ($n=2$; 1.2%), Black ($n=1$; 0.6%), Latin American ($n=1$; 0.6%), or other ($n=1$; 0.6%). Based on parent report, 23 children (13.5%) experienced some sort of pain (i.e., arthritis/joint pain, chronic back pain, headaches/migraines, chronic muscle pain, and/or recurrent abdominal pain), although only 2 children (1.2%) took medication for pain more than once per week.

Parents had a mean age of 41.23 years ($SD=6.01$) and most were mothers ($n=135$; 78.9%), currently married ($n=122$; 71.3%), had an undergraduate university degree or higher ($n=105$; 61.4%), and reported an annual household income $> \$75,000$ CAD ($n=108$; 63.2%). The majority of parents self-identified as White ($n=147$; 85.9%), followed by mixed race ($n=8$; 4.7%), Asian ($n=6$; 3.5%), First Nations/Aboriginal ($n=3$; 1.8%), Black ($n=2$; 1.2%), Arab ($n=2$; 1.2%), or other ($n=3$; 1.8%).

2.3.2 Experimental Pain Task

Participating children completed the cold pressor task (CPT) with their parent present in the room. The CPT is the most commonly used experimental pain task in children (Birnie, Caes, Wilson, Williams & Chambers, 2014; Birnie, Petter, Boerner, Noel & Chambers, 2012) and has been used to successfully observe parent-child

interactions during children's pain (Moon, Chambers & McGrath, 2011). Use of experimental pain offers benefits of standardization of the pain stimulus and increased feasibility of examining parent-child interactions during child pain over real world pain experiences (Birnie, Caes, et al., 2014; Birnie, Noel, Chambers, von Baeyer & Fernandez, 2011). Children immersed their non-dominant hand to the wrist in $10\pm 1^{\circ}\text{C}$ water for up to an uninformed maximum of four minutes. Children were instructed to keep their hand immersed as long as they could, but that they could remove their hand at any time if it became too uncomfortable or hurt too much. The CPT is considered safe and ethical for use with children (Birnie et al., 2011; von Baeyer et al., 2005). To minimize audience effects, the parent and child were left alone while completing the CPT and were directed to talk to each other as they normally would. Parent-child dyads had a one-minute period to interact prior to the immersion of the child's hand in the water and another minute following the child's removal of the hand from the water. A beep from a digital watch signaled the start and end of both of these waiting periods, as well as to signal the child's removal of their hand from the water if they reached the maximum allowable immersion of time of four minutes. The interaction was digitally audio- and video-recorded. To ensure study protocol was being followed and for safety reasons, the research assistant observed the interaction in real-time from a separate room via closed circuit television.

2.3.3 Measures

Trait Pain Catastrophizing

Children completed the Pain Catastrophizing Scale for Children (PCS-C) (Crombez et al., 2003) and parents completed the Pain Catastrophizing Scale for Parents (PCS-P) (Goubert et al., 2006). Both scales are adapted from the original Pain

Catastrophizing Scale (Sullivan, Bishop & Pivik, 1995) and are widely used self-report measures reflecting children's or parents' trait tendency to catastrophize when the child has pain. Both scales are comprised of 13 items responded to on a 5-point scale from 0 ('not at all') to 4 ('extremely') and yield a total score (range from 0-52) and three subscale scores for rumination, magnification, and helplessness. Higher scores indicate higher levels of trait pain catastrophizing. Factorial, construct, and criterion validity of the PCS-C and PCS-P have been demonstrated with samples of generally healthy children and children with chronic pain aged 8-16 years, and their parents (Crombez et al., 2003; Goubert et al., 2006; Parkerson et al., 2013). Additional predictive validity of the scales have been demonstrated for children's chronic pain experience and associated functioning, and parent affective responses to children's pain (Crombez et al., 2003; Goubert et al., 2006; Pielech et al., 2014). Cronbach's alpha of the trait PCS-C and the PCS-P in the current study were .89 and .92, respectively.

State Pain Catastrophizing

Children and parents also completed state versions of the PCS-C and PCS-P, respectively, to assess their catastrophic thoughts relating specifically to the child's pain during the CPT. State versions of these scales have been adapted from the trait versions and have been used in previous research, particularly for examinations of acute clinical or experimental pediatric pain (Boerner et al., 2015; Vervoort, Goubert, & Crombez, 2009; Vervoort, Goubert, et al., 2011). Both scales are comprised of 6 items; two from each subscale (magnification, rumination, helplessness). Items are responded to on an 11-point numeric rating scale from 0 ('not at all') to 10 ('a lot') with total scores ranging from 0

to 60. Higher scores indicate higher levels of state pain catastrophizing. Cronbach's alpha of the state PCS-C and PCS-P in the current study were .79 and .76, respectively.

Child Pain Outcomes

Children and parents rated the child's worst pain intensity from the CPT using the Faces Pain Scale-Revised (FPS-R) (Hicks, von Baeyer, Spafford, van Korlaar & Goodenough, 2001). The FPS-R is comprised of six faces depicting 'no pain' (neutral face) to 'most pain possible' with excellent demonstrated reliability and validity for self-reported pain in children 4-12 years old (Stinson, Kavanagh, Yamada, Gill & Stevens, 2006). The FPS-R has been used by parents to provide proxy ratings of children's pain in previous research (Boerner, Chambers, Craig, Pillai Riddell & Parker, 2013; Boerner et al., 2015).

Children and parents rated the child's pain unpleasantness from the CPT using an 11-point numeric rating scale from 0 ('not at all unpleasant/horrible/yucky') to 10 ('most unpleasant/horrible/yucky') that has been previously used to assess acute pain with children aged 8-18 years old with good validity (Pagé et al., 2011; Pagé et al., 2012).

Children's pain tolerance was later coded from videotapes of the CPT by a research assistant and was considered the time elapsed in seconds when the child had their hand immersed in the water during the CPT up to a maximum of four minutes (i.e., 240 seconds). This is consistent with previous studies using the CPT to examine children's pain tolerance (Birnie et al., 2012).

Typicality of Others' Behaviour

As a measure of ecological validity, children and parents rated how different the others' behaviour was during the CPT as compared to how they usually act when the

child has hurt or pain. The wording was modified from a previous study observing parent-child interactions during experimental pain (Walker et al., 2006). Children and parents were asked: ‘was your [mom or dad or child] acting the same as usual today or different than usual today when [you or they] did the cold water task?’ Responses were rated on a 5-point scale ranging from 0 ‘not at all different’ to 4 ‘a whole lot different’. On average, children and parents’ rated the others’ behaviour during the CPT close to ‘a little different’ than usual ($M=0.92$, $SD=1.08$ for parent behaviour; $M=1.01$, $SD=1.02$ for child behaviour).

2.3.4 Observed Parent and Child Behaviours

Parent and child verbalizations during the CPT were coded using a set of mutually exclusive and exhaustive subcodes used in similar previous research examining parent-child interactions during the CPT (Moon et al., 2011). Parent verbalizations were classified into 9 subcodes, which were then combined into three broad categories: Attending Talk (i.e., any talk by the parent about the child’s symptoms), Non-Attending Talk (i.e., any talk by the parent that does not focus on the child’s physical sensations or the CPT), or Other Talk (i.e., any talk by the parent that include statements about the procedure, or other). Parent Attending Talk comprised four subcodes, including (1) symptom-focused talk and commands to child (e.g., ‘does it hurt?’); (2) sympathy to child (e.g., ‘you’ll be ok’); (3) procedure-related praise to child (e.g., ‘I’m proud of you’); and (4) procedure time talk and commands to child (e.g., ‘I don’t know how much longer’). Parent Non-Attending Talk comprised two subcodes: (1) nonsymptom-focused talk and commands to child (e.g., ‘think of nice hot sunny day’); and (2) humour to child (e.g., ‘you’re being silly!’). Parent Other Talk comprised three subcodes: (1) other

procedure talk and commands to child (e.g., ‘leave your hand open’); (2) criticism to child (e.g., ‘you’re behaving badly’); (3) other talk to child (e.g., ‘what did you say?’).

Child verbalizations were classified into 7 subcodes, which were then combined into two broad categories: Symptom Complaints (i.e., any talk by the child involving statements about symptoms) or Other Talk (i.e., any other talk by the child). Child symptoms complaints comprised four subcodes: (1) cold/pain symptom talk to parent (e.g., ‘It’s so cold’); (2) anxiety talk to parent (e.g., ‘I’m scared’); (3) procedure time talk to parent (e.g., ‘how long does this last?’); and (4) resistance talk to parent (e.g., ‘I want to take my hand out’). Child Other Talk comprised three subcodes: (1) other procedure talk to parent (e.g., ‘which hand do I use?’); (2) child coping talk to parent (e.g., ‘I can handle this’); and (3) other talk to parent (e.g., ‘what are you doing?’). Parent and child codes were mutually exhaustive and exclusive. Less than 1.0% of parent and child verbalizations were inaudible and were combined with ‘other talk’ subcodes for parents and children, respectively.

This coding scheme is based on the Child-Adult Medical Procedure Interaction Scale-Revised (CAMPIS-R), which was originally developed as an observational coding system to capture interactions between children and adults during pediatric medical procedures (Blount et al., 1997). Similarly modified versions of the CAMPIS-R have been used to capture parent-child interactions during or following experimental pain, with similar parent codes of pain attending, non-attending/distracting or other/uncodeable talk, and child codes of symptom complaints/pain talk and other talk (Caes, Vervoort, Trost, et al., 2012; Vervoort, Caes, Trost, et al., 2011; Walker et al., 2006; Williams et al., 2011).

Parent-child interactions during the CPT were transcribed verbatim before coding. Coding began at the start of the CPT when the child first immersed their hand in the water and ended when the child's pain tolerance was reached (i.e., the child removed their hand from the water) or when 90 seconds had elapsed, whichever came first. Ninety seconds was chosen as the maximum end point of coding given the bimodal distribution for pain tolerance consistently observed in studies using the CPT in this age range (Birnie, Parker & Chambers, 2014; Birnie et al., 2012), including the current study. Just over half (51.5%) of the current study sample reached pain tolerance before 90 seconds, with all but three (1.2%) of the remaining children reaching the maximum allowable immersion time of four minutes (i.e., pain tolerance ceiling).

A primary coder received training from the first author on use of the coding system, and reviewed a coding manual in detail. Nine parent-child interactions from the current study were randomly selected for training purposes. Subcodes were compared and discussed with the first author until adequate reliability was achieved before all remaining videos in the study were coded. To assess interrater reliability, the first author coded a randomly selected 20% of the videos from those not used for training purposes. Kappa statistics were .823 ($SE=.01$) for parent subcodes (.855; $SE=.01$ for broad categories) and .841 ($SE=.02$) for child subcodes (.863; $SE=.02$ for broad categories), indicating excellent interrater agreement (Fleiss, Levin, & Cho Paik, 2003).

Consistent with previous studies (Moon et al., 2011; Vervoort, Caes, Trost, et al., 2011), proportional scores for each parent and child category were obtained by dividing the number of verbalizations in each category by the total number of verbalizations made by that individual. This was done to control for variations in the total number of

verbalizations made by each parent and child, and to make values comparable across dyads. Proportions were considered appropriate given strong linear relations between total number of parent and child verbalizations and length of parent-child interaction as measured by pain tolerance (Yoder & Symons, 2010). Proportions were used in all analyses.

2.3.5 Procedure

After providing informed consent and child assent, parents and children were separated to complete baseline questionnaires, including demographics and trait pain catastrophizing. Following completion of the CPT, parent and children were again separated to provide ratings of the child's pain intensity and pain unpleasantness, as well as state pain catastrophizing. They then completed a measure of typicality of the others' behaviour. After debriefing, parents were given a handout summarizing evidence-based parent responses to minimize children's pain and distress during acute painful experiences.

2.3.6 Data Analysis

Relations between study variables and child age, child sex, and parent sex (mother versus father) were explored using correlations and independent samples t-tests as appropriate to check for significant covariates that should be controlled for in subsequent analyses.

Given study objectives and hypotheses, analyses focused on observed parent and child behaviours previously implicated in children's pain responding (Caes, Vervoort, Trost, et al., 2012; Chambers, Craig & Bennett, 2002; Moon et al., 2011; Vervoort, Caes, Trost, et al., 2011; Walker et al., 2006; Williams et al., 2011). A series of six hierarchical

multiple regressions were used to examine the impact of child and parent trait or state pain catastrophizing (in separate models), and their interaction, on observed (1) parent pain attending talk (2) parent non-attending talk, and (3) child symptom complaints. Given the strong bidirectional influence of parent and child behaviours during parent-child interactions, the observed behaviours of the other member of the dyad were entered as covariates (i.e., child behaviour codes when predicting parent behaviours or vice versa) (Step 1). As appropriate, any additional identified covariates were also added in Step 1. Child and parent pain catastrophizing (trait or state) were entered in the next step (Step 2) to account for main effects before examining their interaction (Step 3). Using the same stepped approach as described above, two additional hierarchical multiple regressions were used to assess the predictive value of child and parent trait or state pain catastrophizing (in separate models) in children's pain tolerance. As is recommended for moderation regression analyses, all predictors were centered (Holmbeck, 2002).

The actor-partner interdependence model (APIM) (Cook & Kenny, 2005; Kenny et al., 2006) was used to assess the impact of child and parent trait or state pain catastrophizing on child and parent reports of the child's pain intensity and pain unpleasantness. APIM is a statistical approach that tests for bidirectional effects in interpersonal relationships. It is ideally suited for studying children and their parents as it accounts for the non-independence of data derived from dyads. Children and parents were treated as distinguishable dyads. APIM was estimated using multilevel modeling procedures and variables were standardized (Cook & Kenny, 2005; Kenny et al., 2006). Figure 2.1 depicts the general model of actor and partner effects of child and parent pain catastrophizing (trait or state) and their influence on child and parent ratings of the child's

pain intensity or unpleasantness. When a significant actor effect is found, it indicates a relation between the respondent's own pain catastrophizing (child or parent) and the same respondent's ratings of the child's pain. When a significant partner effect is found, it indicates a relation between a respondent's own pain catastrophizing (e.g., child or parent) and the other dyad member's ratings of the child's pain (e.g., parent or child). Interactions test for significant differences between size of actor or partner effects between respondents (child or parent).

Power analyses were conducted to determine the estimated power of the obtained sample of 171 parent-child dyads to detect medium effects. Estimations using G*Power 3.1 indicated that with a sample of 171 dyads, assuming an alpha level of .05, the power of the regression *F*-test to detect a significant R^2 increase prediction model for pain catastrophizing in observed child symptom complaints is >95% with a medium effect size ($f^2=.15$). Thus, the study sample size was likely sufficient to detect small to medium effect sizes based on a statistical power of .80. Power estimations based on regression analyses were used for APIM analyses (Chung, Moser, Lennie & Rayens, 2009).

2.4 RESULTS

2.4.1 Relations with Child Age, Child and Parent Sex, and Potential Covariates

Significant correlations were observed between child age and child symptom complaints ($r=-.246, p<.01$), child other talk ($r=.268, p<.01$), parent non-attending talk ($r=.254, p<.01$), parent other talk ($r=-.215, p<.01$), and pain tolerance ($r=.268, p<.01$). As such, child age was controlled for in analyses involving observed parent and child behaviours, and pain tolerance. No significant differences were noted based on child sex for observed child behaviours, or for measures of child pain catastrophizing (trait or

state), self-reported pain intensity and unpleasantness, or pain tolerance. No significant differences were noted between mothers and fathers for observed parent behaviours, or for measures of parent pain catastrophizing (trait or state), or parent-rated child pain intensity and unpleasantness. As such, child and parent sex were not controlled for in subsequent analyses.

Given that children and parents completed a second lab-based interaction task (i.e., a conflict discussion), in addition to the CPT, as part of the larger study (Birnie et al., 2015a), potential task order effects were explored. A significant task order effect was found for child state pain catastrophizing and child self-reported pain, with children who completed the CPT second reporting higher levels of state pain catastrophizing ($M=14.09$; $SD=10.79$ vs. $M=18.04$; $SD=12.62$; $t=-2.21$, $p<.05$) and higher pain intensity ($M=5.08$; $SD=3.02$ vs. $M=4.19$; $SD=2.80$; $t=-1.98$, $p<.05$). Given these findings, task order was controlled for in all subsequent analyses involving child state pain catastrophizing or child self-reported pain intensity.

2.4.2 Child and Parent Pain Catastrophizing and Observed Parent and Child Behaviours

Means and correlations between child and parent measures of pain catastrophizing (trait and state) and observed behaviours are reported in Table 2.1. Based on clinical reference points derived from children with chronic pain (Pielech et al., 2014), children with low ($n=58$; 33.9%), moderate ($n=49$; 28.7%), and high ($n=64$; 37.4%) levels of trait pain catastrophizing were represented. On average, children engaged in greater proportions of symptom complaints as compared with other talk, and parents engaged predominantly in pain attending talk, followed by other talk and non-attending talk.

Parent Attending Talk

In model 1 (model including trait pain catastrophizing), covariates of child behaviours and child age accounted for 19.0% of variance in parent pain attending talk (Step 1: $R=.436$, $F(3, 167)=13.03$, $p<.01$), with only child symptom complaints adding significantly ($\beta=.795$, $p<.01$). Neither child nor parent trait pain catastrophizing (Step 2: $\Delta R^2=.015$, *ns*), nor their interaction (Step 3: $\Delta R^2=.000$, *ns*), were significant predictors.

In model 2 (model including state pain catastrophizing), covariates of child behaviours, child age, and task order accounted for 19.0% of variance in parent pain attending talk (Step 1: $R=.436$; $F(4,166)=9.75$, $p<.01$), with only child symptom complaints adding significantly ($\beta=.801$, $p<.01$). Similar to model 1, neither child or parent state pain catastrophizing (Step 2: $\Delta R^2=.010$, *ns*), nor their interaction (Step 3: $\Delta R^2=.000$, *ns*), were significant predictors.

Parent Non-Attending Talk

In model 1 (model including trait pain catastrophizing), covariates of observed child behaviours and child age accounted for 30.4% of variance in parent non-attending talk (Step 1: $R=.551$, $F(3, 167)=24.31$, $p<.01$), with only child other talk adding significantly ($\beta=.539$, $p<.05$). Neither child or parent trait pain catastrophizing (Step 2: $\Delta R^2=.006$, *ns*), nor their interaction (Step 3: $\Delta R^2=.000$, *ns*), were significant predictors.

In model 2 (model including state pain catastrophizing), observed child behaviours, child age, and task order accounted for 30.5% of variance (Step 1: $R=.552$, $F(4, 166)=18.19$, $p<.01$), with only child other talk adding significantly ($\beta=.590$, $p<.05$). Neither child or parent state pain catastrophizing (Step 2: $\Delta R^2=.017$, *ns*), nor their interaction (Step 3: $\Delta R^2=.000$, *ns*), were significant predictors.

Child Symptom Complaints

In model 1 (model including trait pain catastrophizing), covariates of observed parent behaviours and child age accounted for a significant 32.1% of variance in child symptom complaints (Step 1: $R=.567$, $F(4, 166)=19.64$, $p<.01$), with child age ($\beta=-.156$, $p<.05$) and parent non-attending talk ($\beta=-.739$, $p<.01$) adding significantly. Neither child or parent trait pain catastrophizing (Step 2: $\Delta R^2=.014$, *ns*), nor their interaction (Step 3: $\Delta R^2=.005$, *ns*), were significant predictors.

In model 2 (model including state pain catastrophizing), observed parent behaviours, child age, and task order accounted for a significant 32.2% of variance (Step 1: $R=.568$, $F(5, 165)=15.69$, $p<.01$), with child age ($\beta=-.157$, $p<.05$), parent non-attending talk ($\beta=-.746$, $p<.01$), and parent other talk ($\beta=-.386$, $p<.05$) adding significantly. Child and parent state pain catastrophizing (step 2), and their interaction (step 3) all added significantly ($\beta=.247$, $p<.01$, $\beta=.214$, $p<.01$, $\beta=-.131$, $p<.05$, respectively), with the final model accounting for 44.2% of variance in child symptom complaints ($R=.665$, $F(8,162)=16.06$, $p<.01$).

To determine whether a relation between child state pain catastrophizing and child symptom complaints was significant at low and/or high levels of parent state pain catastrophizing, additional probing of the significant interaction between child and parent state pain catastrophizing was conducted following a recommended process for interpreting significant interactions with continuous variables (Holmbeck, 2002). To avoid artificially dichotomizing participants into two groups, two new conditional moderator variables were computed at high (+1 SD above the mean) and low (-1 SD below the mean) values using data from all dyads, allowing examination of conditional

effects of the continuous moderator (parent state pain catastrophizing) on the outcome (Holmbeck, 2002). To illustrate the interaction effect, regression lines were calculated and plotted (see Figure 2.2). These analyses indicated that the relation between child state pain catastrophizing and child symptom complaints was only significant for low levels of parent state pain catastrophizing ($\beta=.378, p<.01$), but not for high levels of parent state pain catastrophizing ($\beta=.130, ns$). Additional analyses revealed that higher levels of parent state pain catastrophizing were associated with greater child symptom complaints, but only when levels of child state pain catastrophizing were low ($\beta=.343, p<.01$) and not when levels of child state pain catastrophizing were high ($\beta=.095, ns$). Stated otherwise, children with high levels of state pain catastrophizing had a greater proportion of symptom complaints regardless of the level of parent state pain catastrophizing; whereas children with low levels of state pain catastrophizing had significantly more symptom complaints only with parents who had high levels of state pain catastrophizing.

The significant findings relating child and parent trait and state pain catastrophizing and observed behaviours during child pain are summarized in Figure 2.3.

2.4.3 Child and Parent Pain Catastrophizing and Child Pain Outcomes

Means and correlations for child pain outcomes with child and parent measures of pain catastrophizing (trait and state) are reported in Table 2.2. No significant differences were noted between children's and parents' ratings of child pain intensity ($t(170)=.902, ns$) or pain unpleasantness ($t(170)=-.653, ns$). Table 2.3 presents the actor and partner effects, and interactions, for trait and state pain catastrophizing on ratings of child pain intensity and pain unpleasantness.

Pain Intensity

For trait pain catastrophizing, only significant actor effects for the child were observed for self-reported pain intensity. No actor effect for parents, and no partner effects were found.

For state pain catastrophizing, significant actor and partner effects were observed for ratings of children's pain intensity, as well as significant interactions between respondent (parent or child) by actor and respondent by partner effects. More specifically, although both children and parents' state pain catastrophizing predicted their own ratings of child pain intensity, this relation was significantly stronger for children. The partner effects were stronger and only significant for parents, meaning that child state pain catastrophizing predicted parent ratings, while parent state pain catastrophizing did not predict child ratings.

Pain Unpleasantness

For trait pain catastrophizing, significant actor effects were observed for both children and parents, indicating a direct relation between children and parents' trait pain catastrophizing and their own ratings of child pain unpleasantness. No partner effects or interactions were found.

For state pain catastrophizing, significant actor effects and a significant respondent by actor interaction was found, indicating that while both children and parents' state pain catastrophizing predicted their own ratings of child pain unpleasantness, this relation was significantly stronger for children. Significant partner effects were also observed for ratings of child pain unpleasantness, although this was only for parents, meaning that child state pain catastrophizing additionally predicted parent ratings, but not vice versa.

Pain Tolerance

In model 1 (model with trait pain catastrophizing), child age accounted for 7.2% of variance in pain tolerance (Step 1: $R=.268$; $F(1, 169)=13.08$, $p<.01$). Neither child or parent trait pain catastrophizing (Step 2: $\Delta R^2=.006$, *ns*), nor their interaction (Step 3: $\Delta R^2=.004$, *ns*), were significant predictors of child pain tolerance.

In model 2 (model including state pain catastrophizing), covariates of child age and task order accounted for 7.4% of variance in pain tolerance (Step 1: $R=.272$; $F(2,168)=6.74$, $p<.01$), with only child age adding significantly ($\beta=-.269$, $p<.01$). Child and parent state pain catastrophizing accounted for an additional 9.0% of variance (Step 2: $R=.405$; $F(2,166)=8.91$, $p<.01$), with only child state pain catastrophizing adding significantly ($\beta=-.278$, $p<.01$). The interaction between child and parent state pain catastrophizing added no predictive value (Step 3: $\Delta R^2=.007$, *ns*).¹

2.5 DISCUSSION

This dyadic investigation was ideally suited for examining intra- and interpersonal influences of child and parent pain catastrophizing on children's pain. Analyses revealed interpersonal contributions of parent state pain catastrophizing to child symptom complaints, and child state pain catastrophizing to parent ratings of child pain. These findings contribute new information to a growing number of studies identifying catastrophic thoughts about child pain by children and parents as interdependent mechanisms that influence children's pain (Esteve et al., 2014; Noel et al., 2015; Vervoort et al., 2013).

A unique finding was a significant interaction between child and parent state pain catastrophizing in influencing child symptom complaints. Children reporting higher state

pain catastrophizing demonstrated greater symptom complaints, consistent with previous research (Vervoort et al., 2008; Vervoort, Caes, Trost, et al., 2011; Vervoort, Goubert, Eccleston et al., 2009). This could reflect a communal coping approach to pain (Sullivan, 2012), which suggests increased pain expression amongst individuals with high pain catastrophizing as a means of eliciting support from others to manage their pain and distress. However, given that similar higher amounts of symptom complaints occurred irrespective of level of parent state pain catastrophizing, this could also reflect poor self-regulatory coping processes. This would be consistent with work indicating that children with high levels of pain catastrophizing engage indiscriminately in greater facial pain expression (Vervoort, Caes, Trost, et al., 2011). Higher state pain catastrophizing by children, but not parents, predicted lower pain tolerance, which may also serve to communicate difficulty coping to parents (Vervoort et al., 2013). Although poorer pain outcomes were expected for dyads with both high child and parent pain catastrophizing (Goubert & Simons, 2014; Williams, Logan, et al., 2012), no significant difference in symptom complaints was observed when both reported high state pain catastrophizing as compared to when only the child reported higher state pain catastrophizing.

Children with low state pain catastrophizing and a parent with high state pain catastrophizing had increased symptom complaints, at levels comparable to children with high state pain catastrophizing. This suggests modulation of children's verbal expressions of pain based on parent coping, although more research is needed to determine the specific mechanisms at play. Greater verbal pain behaviours by these children may reflect learned behaviours observed from the greater pain expressivity modeled by their parents with high pain catastrophizing (Goubert, Vlaeyen, Crombez & Craig, 2011; Goodman &

McGrath, 2003) or reinforcement of child pain behaviours (Esteve et al., 2014). It is also possible that greater symptom complaints were needed to elicit parent support as parents with high pain catastrophizing have been reported to attend away from children displaying low facial pain expressions (Vervoort, Caes, Crombez, et al., 2011), which is likely amongst children with low pain catastrophizing. Given the associations between parent state pain catastrophizing and observed parent behaviours, and the interdependence of parent-child interactions, greater symptom complaints could also arise from greater pain attending talk by parents with higher pain catastrophizing. However, no impact of parent or child pain catastrophizing on parent behaviours was observed. Nevertheless, interpersonal fear avoidance processes suggest that high levels of parent pain catastrophizing places children with low pain catastrophizing at greater risk for maladaptive pain cognitions and coping, than they would be with a parent with low pain catastrophizing or if considered on their own (Goubert & Simons, 2014). Taken together, this study's findings suggest that the social environment has a stronger influence on the pain behaviours of children with low pain catastrophizing; whereas the internal environment appears more central to the pain behaviours of children with high pain catastrophizing.

To account for the bidirectionality of parent-child interactions, child or parent behaviours were included as covariates prior to examining any impact of parent or child pain catastrophizing on parent or child behaviours, respectively. This may explain discrepancies between the lack of significant influences of parent or child pain catastrophizing on parent behaviours in this study with those that have been previously reported (Caes, Vervoort, Trost, et al., 2012; Vervoort, Caes, Trost, et al., 2011). The

observed interdependent interactional patterns between parents and children are reported in previous work and indicate that parent-child dyads tend to engage in either adaptive or maladaptive interactions, respectively associated with better or worse child pain and distress (Blount et al., 1989; Chambers et al., 2002; Spagrud et al., 2008; Taylor, Sellick & Greenwood, 2011; Walker et al., 2006).

Consistent with previous research, greater trait and/or state pain catastrophizing by children and parents predicted their own higher ratings of child pain intensity and unpleasantness (Boerner et al., 2015; Esteve et al., 2014; Goubert et al., 2009; Vervoort, Caes, Trost, et al., 2011; Vervoort, Goubert, Eccleston et al., 2009; Vervoort, Goubert, et al., 2011). Only parent trait pain catastrophizing did not predict parent ratings of child pain intensity. Child state pain catastrophizing additionally influenced parent ratings of child pain. This interpersonal effect has not been previously reported, and may occur due to greater verbal or nonverbal pain expression by children with high pain catastrophizing (Vervoort, Caes, Trost, et al., 2011; Vervoort, Goubert, & Crombez, 2009; Vervoort, Goubert, Eccleston, et al., 2009) and/or differential attention to children's facial pain expressions based on level of parent pain catastrophizing (Vervoort, Caes, Crombez, et al., 2011). Similar to prior work (Boerner et al., 2015), no interpersonal influence of parent pain catastrophizing on children's self-reported pain was found. Future research should explore what dyadic variations of child and parent pain catastrophizing contribute to greater congruency in child pain ratings (Goubert et al., 2009; Vervoort, Goubert & Crombez, 2009). Altogether, these findings support both bottom-up (child pain expression) and top-down (parent characteristics) processes in observers' perceptions of other's pain (Craig et al., 2010; Goubert et al., 2005; Hadjistavropoulos & Craig, 2002;

Hadjistavropoulos et al., 2011; Vervoort, Caes, Trost, et al., 2011; Vervoort et al., 2008; Vervoort, Goubert, & Crombez, 2009; Vervoort, Goubert, & Eccleston, et al., 2009; Vervoort, Goubert, et al., 2011).

Associations between child and parent pain catastrophizing (trait or state) were not significant. These findings are inconsistent with research in pediatric chronic pain (Cunningham et al., 2014; Lynch-Jordan et al., 2013; Pielech et al., 2014; Simons et al., 2015; Vowles et al., 2010; Welkom et al., 2013) and reported genetic heritability of pain catastrophizing (Trost et al., 2015), but align with studies of pediatric post-surgical or procedural pain that report no associations between overall levels of child and parent state or trait pain catastrophizing (Noel et al., 2015; Vervoort, Goubert, et al., 2011; Vervoort et al., 2013). It could be that children and parents come to view pain more similarly through the shared experience of chronic pain, particularly for those who may have a predisposition to cope poorly (Lynch-Jordan et al., 2013). Nevertheless, the lack of a significant relation between child and parent pain catastrophizing strengthens our conclusions regarding interpersonal influences on children's experimental pain, as their unique contributions arise from distinct child and parent perspectives. Our findings also highlight the important distinction between state and trait pain catastrophizing, and the salience of the former to children's experimental pain. This is consistent with prior work that more strongly implicates state pain catastrophizing in experimental pain in adults with and without chronic pain (Campbell et al., 2010). Future research should explore relations between state and trait pain catastrophizing in children and parents, as research with adults indicates that trait pain catastrophizing predisposes individuals to higher state

pain catastrophizing, and strengthens maladaptive associations between state pain catastrophizing and daily fluctuations in chronic pain (Sturgeon & Zautra, 2013a; 2013b).

Clinically, our findings indicate that both child and parent catastrophic thoughts about specific child pain should be assessed and considered in treatment, as they were more influential to immediate behaviours and pain experience than general beliefs about pain. Although distraction is generally efficacious for managing children's acute pain (Uman et al., 2013), it does not appear effective for children with high pain catastrophizing (Verhoeven, Goubert, Jaaniste, Van Ryckeghem & Crombez, 2012) and is likely ineffectively delivered by parents with high pain catastrophizing given their susceptibility to increased distress (Caes, Vervoort, et al., 2014; Dahlquist & Pendley, 2005). Children reporting high pain catastrophizing may obtain greater benefit from interventions that focus attention on pain in an accepting and non-judgmental way (Petter, McGrath, Chambers & Dick, 2014; Prins, Decuyper & Van Damme, 2014) or that use cognitive-behavioural strategies to restructure catastrophic thoughts (Kashikar-Zuck et al., 2013). Experimental research with adults offers promising evidence for a brief psychological intervention to reduce state pain catastrophizing, and subsequently improve pain (Terry et al., 2015), although research specific to children and parents, and clinical pain, is needed. To our knowledge, no interventions specific to parent pain catastrophizing have been tested, although highly anxious parents, such as those who catastrophize about their child's pain, show decreased distress when directed to focus on versus avoid their child's pain (Vervoort, Trost, Sütterlin, Caes & Moors, 2014).

A limitation of this study is the use of experimental pain to model clinical pain. Although parent- and child-report suggest ecological validity of observed behaviours,

evidence supporting the generalizability of CPT findings to the real world is limited (Birnie, Caes, et al., 2014). Fear and nervousness regarding the CPT may be more comparable to that experienced during a needle for children with high levels of pain catastrophizing (Boerner et al., 2015); however, replication during clinical pain is necessary. Although measures of child and parent state pain catastrophizing have been used in previous research (Boerner et al., 2015), were developed from well-validated and reliable trait measures (Crombez et al., 2003; Goubert et al., 2006), and showed acceptable reliability in this study, there is currently little information regarding their psychometric properties. Despite these limitations, strengths of this study include its sample size and application of dyadic analysis to parent-child dyads (Kenny et al., 2006), observation of parent and child behaviours (Cohen, Manimala & Blount, 2000), and >20% representation of fathers who are underrepresented in pediatric pain research (Birnie, Boerner & Chambers, 2014).

Future research should investigate mechanisms through which observed interpersonal influences are initiated or maintained. Application of sequential analysis to parent-child interactions during children's acute pain has revealed important nuances in the complex bidirectionality of these exchanges (Taylor et al., 2011). This work could inform interventions by elucidating what role child or parent pain catastrophizing play in these maladaptive interactions that lead to poorer pain. An important goal is to test these complex intra- and inter-personal influences of child and parent pain catastrophizing in an integrated model, taking into account other parent (e.g., distress, sex) (Caes, Vervoort, et al., 2014; Hechler et al., 2011; Vervoort, Huguet, et al., 2011), child (e.g., age, sex) (Birnie, Parker, & Chambers, 2014, Boerner, Birnie, Caes, Schinkel & Chambers, 2014),

and contextual (e.g., pain-related threat) (Boerner et al., 2015; Caes, Vervoort, Trost, et al., 2012; Williams et al., 2011) factors shown to influence behaviours and perceptions of children's pain.

Research to date has predominantly explored child or parent pain catastrophizing in isolation from one another, with an emerging focus on dyadic influences. This dyadic investigation revealed newly identified interpersonal influences of parent and child state pain catastrophizing on children's pain behaviours and parent ratings of child pain.

Findings reiterate the complex social context of pain, and identify the relevance of both child and parent coping to treatment selection, and when interpreting perceptions of children's pain.

2.6 REFERENCES

- Birnie, K. A., Boerner, K. E., & Chambers, C. T. (2014). Families and pain. In P. J. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), *Oxford textbook of paediatric pain*. (pp. 111-118). Oxford, United Kingdom: Oxford University Press.
- Birnie, K. A., Caes, L., Wilson, A. C., Williams, S. E., & Chambers, C. T. (2014). A practical guide and perspectives on the use of experimental pain modalities with children and adolescents. *Pain Management*, 4(2), 97-111. doi:10.2217/pmt.13.72
- Birnie, K. A., Chambers, C. T., Chorney, J., Fernandez, C. V., & McGrath, P. J. (2015a). *A multi-informant multi-method investigation of family functioning and parent-child coping during child pain*. Manuscript submitted for publication.
- Birnie, K. A., Noel, M., Chambers, C. T., von Baeyer, C. L., & Fernandez, C. V. (2011). The cold pressor task: Is it an ethically acceptable pain research method in children? *Journal of Pediatric Psychology*, 36(10), 1071-1081. doi:10.1093/jpepsy/jsq092
- Birnie, K. A., Parker, J. A., & Chambers, C. T. (2014). Relevance of water temperature, apparatus, and age to children's pain during the cold pressor task. *Pain Practice*. Advance online access. doi:10.1111/papr.12257
- Birnie, K. A., Petter, M., Boerner, K. E., Noel, M., & Chambers, C. T. (2012). Contemporary use of the cold pressor task in pediatric pain research: A systematic review of methods. *The Journal of Pain*, 13(9), 817-826. doi:10.1016/j.jpain.2012.06.005
- Blount, R. L., Cohen, L. L., Frank, N. C., Bachanas, P. J., Smith, A. J., Manimala, M. R., et al. (1997). The child-adult medical procedure interaction scale-revised: An assessment of validity. *Journal of Pediatric Psychology*, 22(1), 73-88. doi:10.1093/jpepsy/22.1.73
- Blount, R. L., Corbin, S. M., Sturges, J. W., Wolfe, V. V., Prater, J. M., & James, L. D. (1989). The relationship between adults' behavior and child coping and distress during BMA/LP procedures: A sequential analysis. *Behavior Therapy*, 20(4), 585-601. doi:10.1016/s0005-7894(89)80136-4
- Boerner, K. E., Birnie, K. A., Caes, L., Schinkel, M., & Chambers, C. T. (2014). Sex differences in experimental pain among healthy children: A systematic review and meta-analysis. *Pain*, 155(5), 983-993. doi:10.1016/j.pain.2014.01.031
- Boerner, K. E., Chambers, C. T., Craig, K. D., Pillai Riddell, R. R., & Parker, J. A. (2013). Caregiver accuracy in detecting deception in facial expressions of pain in children. *Pain*, 154(4), 525-533. doi:10.1016/j.pain.2012.12.015

- Boerner, K. E., Noel, M., Birnie, K. A., Caes, L., Petter, M., & Chambers, C. T. (2015). Impact of threat level, task instruction, and individual characteristics on cold pressor pain and fear among children and their parents. *Pain Practice*. Advance online access. doi:10.1111/papr.12306
- Caes, L., Goubert, L., Devos, P., Verlooy, J., Benoit, Y., & Vervoort, T. (2014). The relationship between parental catastrophizing about child pain and distress in response to medical procedures in the context of childhood cancer treatment: A longitudinal analysis. *Journal of Pediatric Psychology*, *39*(7), 677-686. doi:10.1093/jpepsy/jsu034
- Caes, L., Vervoort, T., Devos, P., Verlooy, J., Benoit, Y., & Goubert, L. (2014). Parental distress and catastrophic thoughts about child pain: Implications for parental protective behavior in the context of child leukemia-related medical procedures. *The Clinical Journal of Pain*, *30*(9), 787-799. doi:10.1097/ajp.0000000000000028
- Caes, L., Vervoort, T., Eccleston, C., & Goubert, L. (2012). Parents who catastrophize about their child's pain prioritize attempts to control pain. *Pain*, *153*(8), 1695-1701. doi:10.1016/j.pain.2012.04.028
- Caes, L., Vervoort, T., Eccleston, C., Vandenhende, M., & Goubert, L. (2011). Parental catastrophizing about child's pain and its relationship with activity restriction: The mediating role of parental distress. *Pain*, *152*(1), 212-222. doi:10.1016/j.pain.2010.10.037
- Caes, L., Vervoort, T., Trost, Z., & Goubert, L. (2012). Impact of parental catastrophizing and contextual threat on parents' emotional and behavioral responses to their child's pain. *Pain*, *153*(3), 687-695. doi:10.1016/j.pain.2011.12.007
- Campbell, C. M., Kronfli, T., Buenaver, L. F., Smith, M. T., Berna, C., Haythornthwaite, J. A., et al. (2010). Situational versus dispositional measurement of catastrophizing: Associations with pain responses in multiple samples. *The Journal of Pain*, *11*(5), 443-453.e2. doi:10.1016/j.jpain.2009.08.009
- Chambers, C. T., Craig, K. D., & Bennett, S. M. (2002). The impact of maternal behavior on children's pain experiences: An experimental analysis. *Journal of Pediatric Psychology*, *27*(3), 293-301. doi:10.1093/jpepsy/27.3.293
- Cohen, L. L., Manimala, R., & Blount, R. L. (2000). Easier said than done: What parents say they do and what they do during children's immunizations. *Children's Health Care*, *29*(2), 79-86. doi:10.1207/s15326888chc2902_1
- Cook, W. & Kenny, D. (2005). The actor-partner interdependence model: A model of bidirectional effects in developmental studies. *International Journal of Behavioral Development*, *29*(2), 101-109. doi:10.1080/01650250444000405

- Craig, K. D., Versloot, J., Goubert, L., Vervoort, T., & Crombez, G. (2010). Perceiving pain in others: Automatic and controlled mechanisms. *The Journal of Pain, 11*(2), 101-108. doi:10.1016/j.jpain.2009.08.008
- Crombez, G., Bijttebier, P., Eccleston, C., Mascagni, T., Mertens, G., Goubert, L., et al. (2003). The child version of the pain catastrophizing scale (PCS-C): A preliminary validation. *Pain, 104*(3), 639-646. doi:10.1016/s0304-3959(03)00121-0
- Cunningham, N. R., Lynch-Jordan, A., Barnett, K., Peugh, J., Sil, S., Goldschneider, K., et al. (2014). Child pain catastrophizing mediates the relation between parent responses to pain and disability in youth with functional abdominal pain. *Journal of Pediatric Gastroenterology and Nutrition, 59*(6), 732-738. doi:10.1097/mpg.0000000000000529
- Dahlquist, L. M., & Pendley, J. S. (2005). When distraction fails: Parental anxiety and children's responses to distraction during cancer procedures. *Journal of Pediatric Psychology, 30*(7), 623-8. doi:10.1093/jpepsy/jsi048
- Dahlquist, L. M., Power, T. G., Cox, C. N., & Fernbach, D. J. (1994). Parenting and child distress during cancer procedures: A multidimensional assessment. *Children's Health Care, 23*(3), 149-166. doi:10.1207/s15326888chc2303_1
- Esteve, R., Marquina-Aponte, V., & Ramírez-Maestre, C. (2014). Postoperative pain in children: Association between anxiety sensitivity, pain catastrophizing, and female caregivers' responses to children's pain. *The Journal of Pain, 15*(2), 157-168.e1. doi:10.1016/j.jpain.2013.10.007
- Fleiss, J. L., Levin, B., & Cho Paik, M. (2003). *Statistical methods for rates and proportions* (3rd ed.). New York, NY: John Wiley & Sons, Inc.
- Goodman, J. E. & McGrath, P. J. (2003). Mothers' modeling influences children's pain during a cold pressor task. *Pain, 104*(3), 559-565. doi:10.1016/s0304-3959(03)00090-3
- Goubert, L. & Simons, L. E. (2014). Cognitive styles and processes in paediatric pain. In P. J. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), *Oxford textbook of paediatric pain*. (pp. 95-101). Oxford, United Kingdom: Oxford University Press.
- Goubert, L., Craig, K. D., Vervoort, T., Morley, S., Sullivan, M. J., de C Williams, A. C., et al. (2005). Facing others in pain: The effects of empathy. *Pain, 118*(3), 285-288. doi:10.1016/j.pain.2005.10.025
- Goubert, L., Eccleston, C., Vervoort, T., Jordan, A., & Crombez, G. (2006). Parental catastrophizing about their child's pain. The parent version of the pain catastrophizing scale (PCS-P): A preliminary validation. *Pain, 123*(3), 254-263. doi:10.1016/j.pain.2006.02.035

- Goubert, L., Vervoort, T., Cano, A., & Crombez, G. (2009). Catastrophizing about their children's pain is related to higher parent-child congruency in pain ratings: An experimental investigation. *European Journal of Pain, 13*(2), 196-201. doi:10.1016/j.ejpain.2008.03.009
- Goubert, L., Vervoort, T., Sullivan, M. J., Verhoeven, K., & Crombez, G. (2008). Parental emotional responses to their child's pain: The role of dispositional empathy and catastrophizing about their child's pain. *The Journal of Pain, 9*(3), 272-279. doi:10.1016/j.jpain.2007.11.006
- Guite, J. W., McCue, R. L., Sherker, J. L., Sherry, D. D., & Rose, J. B. (2011). Relationships among pain, protective parental responses, and disability for adolescents with chronic musculoskeletal pain: The mediating role of pain catastrophizing. *The Clinical Journal of Pain, 27*(9), 775-781. doi:10.1016/j.jpain.2009.01.251
- Hadjistavropoulos, T. & Craig, K. D. (2002). A theoretical framework for understanding self-report and observational measures of pain: A communications model. *Behaviour Research and Therapy, 40*(5), 551-570. doi:10.1016/s0005-7967(01)00072-9
- Hadjistavropoulos, T., Craig, K. D., Duck, S., Cano, A., Goubert, L., Jackson, P. L., et al. (2011). A biopsychosocial formulation of pain communication. *Psychological Bulletin, 137*(6), 910-939. doi:10.1037/a0023876
- Hechler, T., Vervoort, T., Hamann, M., Tietze, A. L., Vocks, S., Goubert, L., et al. (2011). Parental catastrophizing about their child's chronic pain: Are mothers and fathers different? *European Journal of Pain, 15*(5), 515.e1-9. doi:10.1016/j.ejpain.2010.09.015
- Hermann, C., Hohmeister, J., Zohsel, K., Tuttas, M. L., & Flor, H. (2008). The impact of chronic pain in children and adolescents: Development and initial validation of a child and parent version of the pain experience questionnaire. *Pain, 135*(3), 251-61. doi:10.1016/j.pain.2007.06.002
- Hicks, C. L., von Baeyer, C. L., Spafford, P. A., van Korlaar, I., & Goodenough, B. (2001). The faces pain scale-revised: Toward a common metric in pediatric pain measurement. *Pain, 93*(2), 173-183. doi:10.1016/s0304-3959(01)00314-1
- Holmbeck, G. N. (2002). Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *Journal of Pediatric Psychology, 27*(1), 87-96. doi:10.1093/jpepsy/27.1.87
- Kashikar-Zuck, S., Sil, S., Lynch-Jordan, A. M., Ting, T. V., Peugh, J., Schikler, K. N., et al. (2013). Changes in pain coping, catastrophizing, and coping efficacy after cognitive-behavioral therapy in children and adolescents with juvenile fibromyalgia. *The Journal of Pain, 14*(5), 492-501. doi:10.1016/j.jpain.2012.12.019

- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: The Guilford Press.
- Langer, S. L., Romano, J. M., Mancl, L., & Levy, R. L. (2014). Parental catastrophizing partially mediates the association between parent-reported child pain behavior and parental protective responses. *Pain Research and Treatment, 2014*, 1-9. doi:10.1155/2014/751097
- Larochette, A. C., Chambers, C. T., & Craig, K. D. (2006). Genuine, suppressed and faked facial expressions of pain in children. *Pain, 126*(1-3), 64-71. doi:10.1016/j.pain.2006.06.013
- Logan, D. E., Engle, L. B., Feinstein, A. B., Sieberg, C. B., Sparling, P., Cohen, L. L., et al. (2012). Ecological system influences in the treatment of pediatric chronic pain. *Pain Research & Management, 17*(6), 407-411.
- Lynch-Jordan, A. M., Kashikar-Zuck, S., Szabova, A., & Goldschneider, K. R. (2013). The interplay of parent and adolescent catastrophizing and its impact on adolescents' pain, functioning, and pain behavior. *The Clinical Journal of Pain, 29*(8), 681-688. doi:10.1097/ajp.0b013e3182757720
- Moon, E. C., Chambers, C. T., & McGrath, P. J. (2011). "He says, she says": A comparison of fathers' and mothers' verbal behavior during child cold pressor pain. *The Journal of Pain, 12*(11), 1174-1181. doi:10.1016/j.jpain.2011.06.004
- Noel, M., Rabbitts, J. A., Tai, G. G., & Palermo, T. M. (2015). Remembering pain after surgery: A longitudinal examination of the role of pain catastrophizing in children's and parents' recall. *Pain, 156*(5), 800-808. doi:10.1097/j.pain.000000000000102
- Pagé, M. G., Campbell, F., Isaac, L., Stinson, J., Martin-Pichora, A. L., & Katz, J. (2011). Reliability and validity of the child pain anxiety symptoms scale (CPASS) in a clinical sample of children and adolescents with acute postsurgical pain. *Pain, 152*(9), 1958-1965. doi:10.1016/j.pain.2011.02.053
- Pagé, M. G., Katz, J., Stinson, J., Isaac, L., Martin-Pichora, A. L., & Campbell, F. (2012). Validation of the numerical rating scale for pain intensity and unpleasantness in pediatric acute postoperative pain: Sensitivity to change over time. *The Journal of Pain, 13*(4), 359-369. doi:10.1016/j.jpain.2011.12.010
- Palermo, T. M. & Chambers, C. T. (2005). Parent and family factors in pediatric chronic pain and disability: An integrative approach. *Pain, 119*(1-3), 1-4. doi:10.1016/j.pain.2005.10.027
- Palermo, T. M., Valrie, C. R., & Karlson, C. W. (2014). Family and parent influences on pediatric chronic pain: A developmental perspective. *The American Psychologist, 69*(2), 142-152. doi:10.1037/a0035216

- Parkerson, H. A., Noel, M., Pagé, M. G., Fuss, S., Katz, J., & Asmundson, G. J. (2013). Factorial validity of the english-language version of the pain catastrophizing scale--child version. *The Journal of Pain, 14*(11), 1383-1389. doi:10.1016/j.jpain.2013.06.004
- Petter, M., McGrath, P. J., Chambers, C. T., & Dick, B. D. (2014). The effects of mindful attention and state mindfulness on acute experimental pain among adolescents. *Journal of Pediatric Psychology, 39*(5), 521-531. doi:10.1093/jpepsy/jsu007
- Pielech, M., Ryan, M., Logan, D., Kaczynski, K., White, M. T., & Simons, L. E. (2014). Pain catastrophizing in children with chronic pain and their parents: Proposed clinical reference points and reexamination of the pain catastrophizing scale measure. *Pain, 155*(11), 2360-2367. doi:10.1016/j.pain.2014.08.035
- Prins, B., Decuyper, A., & Van Damme, S. (2014). Effects of mindfulness and distraction on pain depend upon individual differences in pain catastrophizing: An experimental study. *European Journal of Pain, 18*(9), 1307-1315. doi:10.1002/j.1532-2149.2014.491.x
- Quartana, P. J., Campbell, C. M., & Edwards, R. R. (2009). Pain catastrophizing: A critical review. *Expert Review of Neurotherapeutics, 9*(5), 745-758. doi:10.1586/ern.09.34
- Simons, L. E., Smith, A., Kaczynski, K., & Basch, M. (2015). Living in fear of your child's pain: The parent fear of pain questionnaire. *Pain, 156*(4), 694-702. doi:10.1097/j.pain.000000000000100
- Spagrud, L. J., von Baeyer, C. L., Ali, K., Mpofo, C., Fennell, L. P., Friesen, K., et al. (2008). Pain, distress, and adult-child interaction during venipuncture in pediatric oncology: An examination of three types of venous access. *Journal of Pain and Symptom Management, 36*(2), 173-184. doi:10.1016/j.jpainsymman.2007.10.009
- Stinson, J. N., Kavanagh, T., Yamada, J., Gill, N., & Stevens, B. (2006). Systematic review of the psychometric properties, interpretability and feasibility of self-report pain intensity measures for use in clinical trials in children and adolescents. *Pain, 125*(1-2), 143-157. doi:10.1503/cmaj.101341
- Sturgeon, J. A. & Zautra, A. J. (2013a). Psychological resilience, pain catastrophizing, and positive emotions: Perspectives on comprehensive modeling of individual pain adaptation. *Current Pain and Headache Reports, 17*(3), 317-326. doi:10.1007/s11916-012-0317-4
- Sturgeon, J. A. & Zautra, A. J. (2013b). State and trait pain catastrophizing and emotional health in rheumatoid arthritis. *Annals of Behavioral Medicine, 45*(1), 69-77. doi:10.1007/s12160-012-9408-z
- Sullivan, M. J. (2012). The communal coping model of pain catastrophizing: Clinical and research implications. *Canadian Psychology, 53*(1), 32-41. doi:10.1037/a0026726

- Sullivan, M. J., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: Development and validation. *Psychological Assessment*, 7(4), 524-532. doi:10.1037//1040-3590.7.4.524
- Taylor, C., Sellick, K., & Greenwood, K. (2011). The influence of adult behaviors on child coping during venipuncture: A sequential analysis. *Research in Nursing & Health*, 34(2), 116-131. doi:10.1002/nur.20424
- Terry, E. L., Thompson, K. A., & Rhudy, J. L. (2015). Experimental reduction of pain catastrophizing modulates pain report but not spinal nociception as verified by mediation analyses. *Pain*, 156(8), 1477-1488. doi:10.1097/j.pain.0000000000000192
- Trost, Z., Strachan, E., Sullivan, M., Vervoort, T., Avery, A. R., & Afari, N. (2015). Heritability of pain catastrophizing and associations with experimental pain outcomes: A twin study. *Pain*, 156(3), 514-520. doi:10.1097/01.j.pain.0000460326.02891.fc
- Uman, L. S., Birnie, K. A., Noel, M., Parker, J. A., Chambers, C. T., McGrath, P. J., et al. (2013). Psychological interventions for needle-related procedural pain and distress in children and adolescents. *Cochrane Database of Systematic Reviews (Online)*, 10, CD005179.
- Verhoeven, K., Goubert, L., Jaaniste, T., Van Ryckeghem, D. M., & Crombez, G. (2012). Pain catastrophizing influences the use and the effectiveness of distraction in schoolchildren. *European Journal of Pain*, 16(2), 256-267. doi:10.1016/j.ejpain.2011.06.015
- Vervoort, T., Caes, L., Crombez, G., Koster, E., Van Damme, S., Dewitte, M., & Goubert, L. (2011). Parental catastrophizing about children's pain and selective attention to varying levels of facial expression of pain in children: A dot-probe study. *Pain*, 152(8), 1751-1757. doi:10.1016/j.pain.2011.03.015
- Vervoort, T., Caes, L., Trost, Z., Sullivan, M., Vangronsveld, K., & Goubert, L. (2011). Social modulation of facial pain display in high-catastrophizing children: An observational study in schoolchildren and their parents. *Pain*, 152(7), 1591-1599. doi:10.1016/j.pain.2011.02.048
- Vervoort, T., Craig, K. D., Goubert, L., Dehoorne, J., Joos, R., Matthys, D., et al. (2008). Expressive dimensions of pain catastrophizing: A comparative analysis of school children and children with clinical pain. *Pain*, 134(1-2), 59-68. doi:10.1016/j.pain.2007.03.038
- Vervoort, T., Eccleston, C., Goubert, L., Buysse, A., & Crombez, G. (2010). Children's catastrophic thinking about their pain predicts pain and disability 6 months later. *European Journal of Pain (London, England)*, 14(1), 90-96. <http://dx.doi.org/10.1016/j.ejpain.2009.03.001>

- Vervoort, T., Craig, K. D., Goubert, L., Dehoorne, J., Joos, R., Matthys, D., et al. (2008). Expressive dimensions of pain catastrophizing: A comparative analysis of school children and children with clinical pain. *Pain, 134*(1-2), 59-68. doi:10.1016/j.pain.2007.03.038
- Vervoort, T., Eccleston, C., Goubert, L., Buysse, A., & Crombez, G. (2010). Children's catastrophic thinking about their pain predicts pain and disability 6 months later. *European Journal of Pain (London, England), 14*(1), 90-96. <http://dx.doi.org/10.1016/j.ejpain.2009.03.001>
- Vervoort, T., Goubert, L., & Crombez, G. (2009). The relationship between high catastrophizing children's facial display of pain and parental judgment of their child's pain. *Pain, 142*(1-2), 142-148. doi:10.1016/j.pain.2008.12.028
- Vervoort, T., Goubert, L., Eccleston, C., Vandenhende, M., Claeys, O., Clarke, J., et al. (2009). Expressive dimensions of pain catastrophizing: An observational study in adolescents with chronic pain. *Pain, 146*(1-2), 170-176. doi:10.1016/j.pain.2009.07.021
- Vervoort, T., Goubert, L., Vandebossche, H., Van Aken, S., Matthys, D., & Crombez, G. (2011). Child's and parents' catastrophizing about pain is associated with procedural fear in children: A study in children with diabetes and their mothers. *Psychological Reports, 109*(3), 879-895. doi:10.2466/07.15.16.21.pr0.109.6.879-895
- Vervoort, T., Huguet, A., Verhoeven, K., & Goubert, L. (2011). Mothers' and fathers' responses to their child's pain moderate the relationship between the child's pain catastrophizing and disability. *Pain, 152*(4), 786-793. doi:10.1016/j.pain.2010.12.010
- Vervoort, T., Trost, Z., Sütterlin, S., Caes, L., & Moors, A. (2014). Emotion regulatory function of parent attention to child pain and associated implications for parental pain control behaviour. *Pain, 155*(8), 1453-1463. doi:10.1016/j.pain.2014.04.015
- Vervoort, T., Trost, Z., & Van Ryckeghem, D. M. (2013). Children's selective attention to pain and avoidance behaviour: The role of child and parental catastrophizing about pain. *Pain, 154*(10), 1979-1988. doi:10.1016/j.pain.2013.05.052
- von Baeyer, C. L., Piira, T., Chambers, C. T., Trapanotto, M., & Zeltzer, L. K. (2005). Guidelines for the cold pressor task as an experimental pain stimulus for use with children. *The Journal of Pain, 6*(4), 218-227. doi:10.1016/j.jpain.2005.01.349
- Vowles, K. E., Cohen, L. L., McCracken, L. M., & Eccleston, C. (2010). Disentangling the complex relations among caregiver and adolescent responses to adolescent chronic pain. *Pain, 151*(3), 680-686. doi:10.1016/j.pain.2010.08.031

- Walker, L. S., Williams, S. E., Smith, C. A., Garber, J., Van Slyke, D. A., & Lipani, T. A. (2006). Parent attention versus distraction: Impact on symptom complaints by children with and without chronic functional abdominal pain. *Pain, 122*(1-2), 43-52. doi:10.1016/j.pain.2005.12.020
- Welkom, J. S., Hwang, W. T., & Guite, J. W. (2013). Adolescent pain catastrophizing mediates the relationship between protective parental responses to pain and disability over time. *Journal of Pediatric Psychology, 38*(5), 541-550. doi:10.1093/jpepsy/jst011
- Williams, S., Logan, D., Sieberg, C., & Simons, L. (2012). Parent/child catastrophizing matches and mismatches: The effect on pain, symptoms, and disability. *The Journal of Pain, 13*(4), S103. doi:10.1016/j.jpain.2012.01.426
- Williams, S. E., Blount, R. L., & Walker, L. S. (2011). Children's pain threat appraisal and catastrophizing moderate the impact of parent verbal behavior on children's symptom complaints. *Journal of Pediatric Psychology, 36*(1), 55-63. doi:10.1093/jpepsy/jsq043
- Wilson, A. C., Moss, A., Palermo, T. M., & Fales, J. L. (2014). Parent pain and catastrophizing are associated with pain, somatic symptoms, and pain-related disability among early adolescents. *Journal of Pediatric Psychology, 39*(4), 418-426. doi:10.1093/jpepsy/jst094
- Yoder, P. J. & Symons, F. J. (2010). *Observational measurement of behavior*. New York, NY: Springer Publishing Company.

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2.8 FOOTNOTES

¹ Given the bimodal distribution and ceiling effect for pain tolerance often seen in pediatric CPT studies (Birnie, Parker, & Chambers, 2014; Birnie et al., 2012), including the current study, two logistic regressions were also conducted examining child and parent trait or state pain catastrophizing in children with low versus high pain tolerance. Children who kept their hand immersed until the maximum allowable immersion time of four minutes (i.e., CPT ceiling) were categorized as having high pain tolerance; all others were categorized as low pain tolerance. An identical pattern of results was found as with hierarchical multiple regressions.

Table 2.1

Means and correlations of child and parent pain catastrophizing and observed behaviours during the CPT.

	Mean	SD	Range	2	3	4	5	6	7	8	9
Child											
1. PCS-C (trait)	20.79	10.85	0-48	.392**	.089	-.063	.057	-.059	-.024	-.047	.032
2. PCS-C (state)	15.89	11.79	0-49		.371**	-.361**	-.009	.125	.092	-.302**	.163*
3. Symptom Complaints ^a	.626	.294	0-1.00			-.966**	.085	.321**	.424**	-.517**	.026
4. Other Talk ^a	.369	.291	0-1.00				-.095	-.300**	-.383**	.539**	-.099
Parent											
5. PCS-P (trait)	17.81	9.12	3-51					.410**	-.071	.013	.100
6. PCS-P (state)	14.24	10.54	0-50						.211**	-.149	-.076
7. Attending Talk ^a	.568	.260	0-1.00							-.596**	-.483**
8. Non-Attending Talk ^a	.207	.238	0-0.96								-.360**
9. Other Talk ^a	.219	.217	0-1.00								

^aProportions of observational behaviour codes. *p<.05 **p<.01

PCS-C: Pain Catastrophizing Scale – Children; PCS-P: Pain Catastrophizing Scale - Parents

Table 2.2

Means and correlations of child CPT pain outcomes with child and parent pain catastrophizing.

	Child Pain Intensity (FPS-R)		Child Pain Unpleasantness (VAS)		Pain Tolerance (seconds)
	Child-Rated	Parent-Rated	Child-Rated	Parent-Rated	
Child					
PCS-C (trait)	.210**	.047	.238**	.077	-.068
PCS-C (state)	.612**	.340**	.707**	.316**	-.302**
Parent					
PCS-P (trait)	-.071	.068	-.015	.179*	-.007
PCS-P (state)	.095	.425**	.167*	.512**	-.148
Mean	4.60	4.39	4.56	4.71	132.10
SD	2.93	2.76	3.10	2.61	102.72
Range	0-10	0-10	0-10	0-10	7-240

*p<.05 **p<.01

Table 2.3

Actor and partner effects of child and parent pain catastrophizing and child CPT pain outcomes.

APIM parameters	Child Pain Intensity (B)		Child Pain Unpleasantness (B)	
	Trait Pain Catastrophizing	State Pain Catastrophizing	Trait Pain Catastrophizing	State Pain Catastrophizing
Actor effects				
Child → Child	.203**	.601**	.246**	.720**
Parent → Parent	.055	.403**	.165**	.470**
Partner effects				
Child → Parent	.035	.270**	.063	.223**
Parent → Child	-.117	.020	-.047	.096
Interaction effects				
Respondent x Actor	-.074	-.099*	-.041	-.125**
Respondent x Partner	.076	.125**	.055	.064

Note. Estimates are standardized regression coefficients. Respondent refers to child or parent
* $p < .05$; ** $p < .01$

Figure 2.1

General model of actor and partner effects of pain catastrophizing and child pain outcomes.

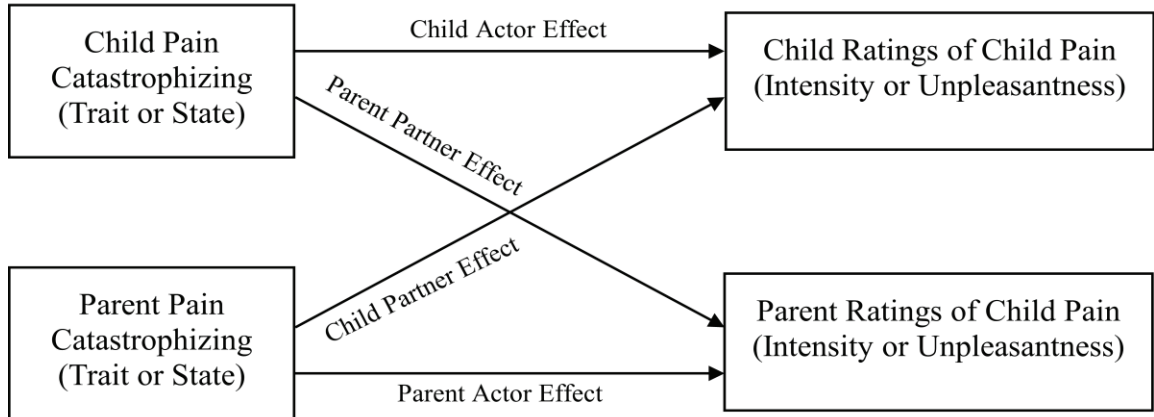


Figure 2.2

Regression lines for the relation between child state pain catastrophizing and child symptom complaints as moderated by parent state pain catastrophizing. $**p < .01$

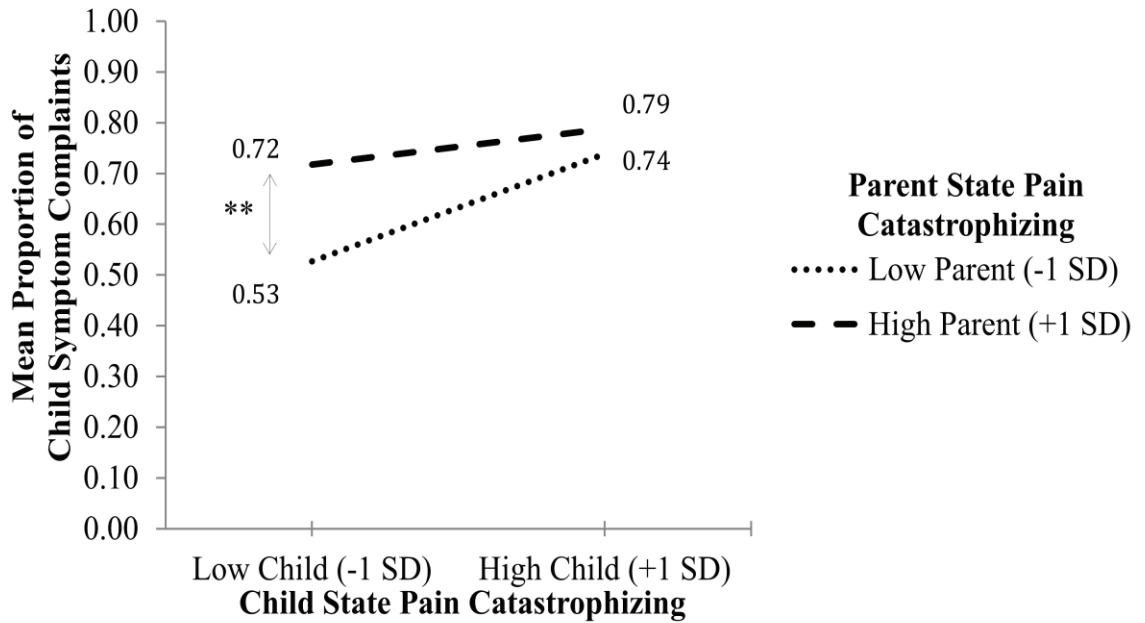
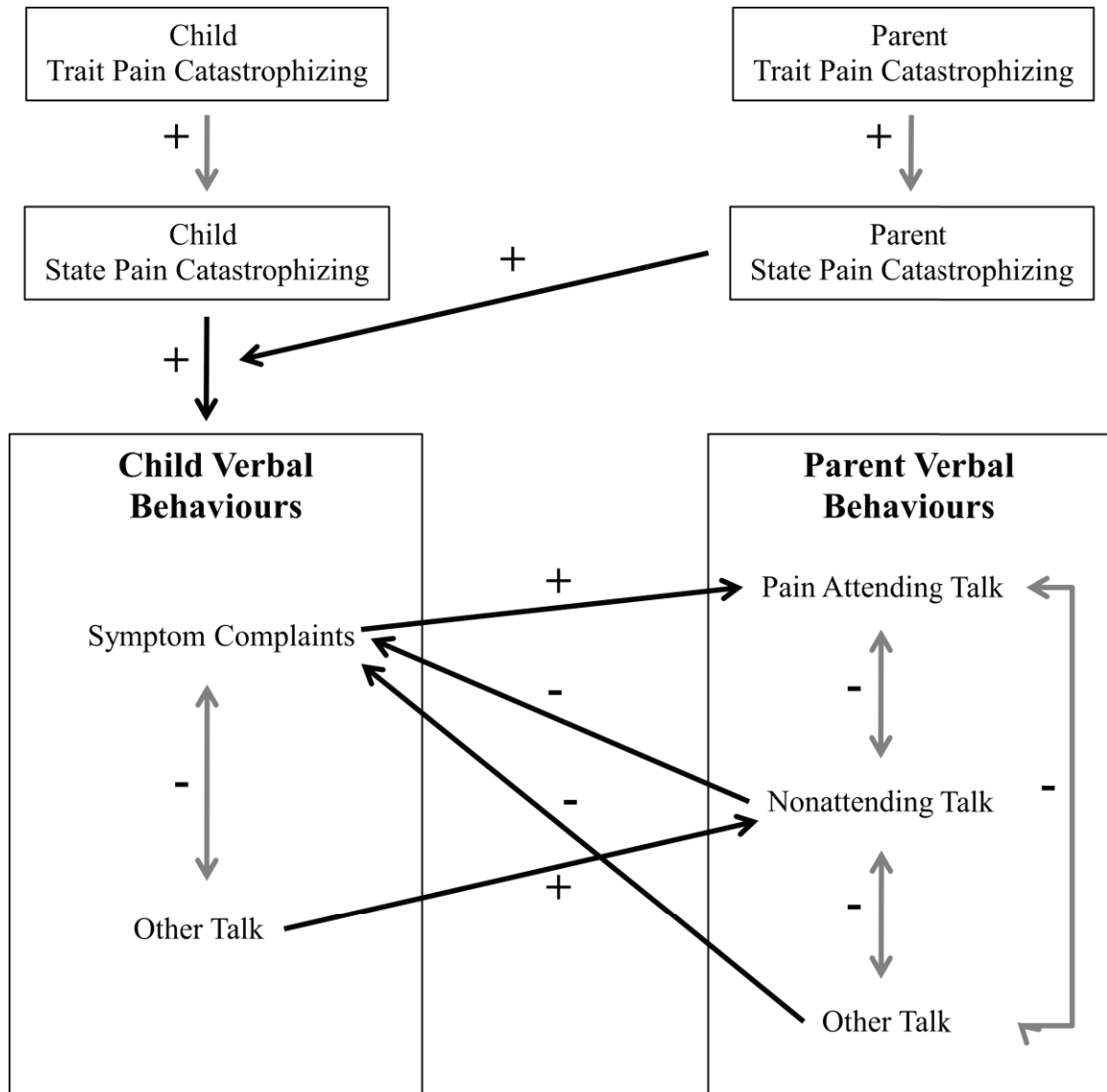


Figure 2.3

Model of significant findings relating child and parent pain catastrophizing and observed parent-child behaviours during the CPT.



Note. Grey lines denote significant correlation; black lines denote significant regression effect. ‘+’: Denotes positive relation/effect between variables; ‘-’: Denotes negative relation/effect between variables;

**CHAPTER 3:
A MULTI-INFORMANT MULTI-METHOD INVESTIGATION OF FAMILY
FUNCTIONING AND PARENT-CHILD COPING DURING CHILD PAIN**

The manuscript based on this study is presented below. Readers are advised that Kathryn Birnie, under the supervision of Dr. Christine Chambers, developed the research questions, methodology, and analytical approach for this research. She was responsible for developing the study protocol and proposal, applying for and obtaining funding to support this research, applying for and obtaining research ethics approval, and overseeing all data collection and coding. She conducted all of the background research and literature review for this manuscript and was responsible for all aspects of the writing process. Prior to submission, she received editorial feedback from the study's co-authors/co-investigators (i.e., dissertation committee members). The manuscript has been submitted to the *Journal of Pediatric Psychology*. The full reference for this manuscript is:

Birnie, K.A., Chambers, C.T., Chorney, J., Fernandez, C.V., & McGrath, P.J. (submitted). A multi-informant multi-method investigation of family functioning and parent-child coping during child pain. *Journal of Pediatric Psychology*.

3.1 ABSTRACT

Objective: To explore relations between family functioning and child pain, including parent-child behaviours, coping, and pain ratings.

Methods: Community sample of 171 dyads comprised of one child aged 8-12 (52% girls) and one parent (79% mothers). Children and parents rated family functioning, trait anxiety, trait and state pain catastrophizing, situational distress, and child pain intensity and unpleasantness following a cold pressor task (CPT). Parent-child interactions during the CPT and a conflict discussion task were coded for verbal behaviours during child pain and observed family functioning, respectively.

Results: Poorer reported family functioning predicted higher child and parent trait anxiety and pain catastrophizing, and parent situational distress. Observed family negativity/conflict, cohesiveness, focus of family problems, and parent emotional support predicted child symptom complaints. Family functioning was not associated with ratings of child pain.

Conclusions: Healthier family functioning was associated with increased child pain expression yet decreased dispositional vulnerability for poor pain coping.

Keywords: pain, cold pressor, family functioning, pain catastrophizing, anxiety, parents, dyadic analysis

3.2 INTRODUCTION

The family is the primary context within which children learn to cope with stressors (Kliewer, Sandler & Wolchik, 1994; Power, 2004; Zimmer-Gembeck & Locke, 2007), including pain (Goubert, Vlaeyen, Crombez & Craig, 2011; Palermo & Chambers, 2005; Palermo, Valrie & Karlson, 2014). In general, children from healthier functioning families, characterized as supportive, warm, predictable, and connected, report feeling less threatened by stressful events, display greater competence, and are more likely to deal with stress in adaptive ways, including greater use of active coping strategies (Ashby Wills, Blechman & McNamara, 1996; Kliewer, Fearnow & Miller, 1996; Zimmer-Gembeck & Locke, 2007). Furthermore, a positive family environment may buffer against the potential negative effects of both major and minor stressors on children (Ashby Wills et al., 1996; Kliewer et al., 1994). On the other hand, children from poorer functioning families, characterized as more chaotic, high in conflict, and having unclear family roles and poor communication (Alderfer et al., 2008), tend to use more avoidant coping strategies, such as efforts to stay away from or avoid thinking about a stressor (Zimmer-Gembeck & Locke, 2007).

In relation to pediatric pain, a systematic review revealed that families of children with chronic pain generally report poorer family functioning than healthy comparison families (Lewandowski, Palermo, Stinson, Handley & Chambers, 2010). Poorer family functioning showed consistent relations with greater child pain-related disability. However, healthier family functioning had a mixed relation with pain intensity, and was associated with either more or less pain (Lewandowski et al., 2010). In the context of chronic pain, poorer family functioning appears in part a consequence of maladaptive

interpersonal parent-child processes (e.g., miscarried helping) (Fales, Essner, Harris & Palermo, 2014) and shows associations with greater parenting stress and worry, parental beliefs about the child's pain as 'being only medical', and greater sense of responsibility by parents for the child's pain (Guite, Logan, McCue, Sherry & Rose, 2009). Poorer family functioning in families with pediatric chronic pain is also related to greater child trait anxiety (Gauntlett-Gilbert & Eccleston, 2007), and greater parent and child trait pain catastrophizing (Jastrowski Mano, Khan, Ladwig & Weisman, 2011), a maladaptive coping style that encompasses the tendency to ruminate, magnify, or feel helpless to manage the child's pain (Crombez et al., 2003; Goubert, Eccleston, Vervoort, Jordan & Crombez, 2006). Children and parents with higher levels of pain catastrophizing and anxiety appear at particular risk for perceiving pain as stressful, threatening, and exceeding their ability to cope, resulting in heightened distress and increased child pain (Crombez et al., 2003; Fisher, Caes, Clinch, Tobias & Eccleston, 2015; Goubert et al., 2006; Link & Fortier, 2015; Pielech et al., 2014; Tremblay & Sullivan, 2010; Vervoort, Eccleston, Goubert, Buysse & Crombez, 2010).

As central members of the family, parents exert a strong influence on child coping by making direct suggestions about how to appraise or cope with a stressor (coaching), through parents' own coping behaviours (modeling), and the family environment within which coping behaviours are learned, enacted, and reinforced (context) (Kliewer et al., 1994). Parent-child communication is a key mechanism through which children are aware of a supportive family environment, and through which parents influence children's appraisals of potential stressors (Ashby Wills et al., 1996; Power, 2004). Observation of parent-child interactions during acute and experimental child pain has supported the

powerful influence of parent coaching and modeling on child pain and coping outcomes (Chambers, Craig & Bennett, 2002; Dahlquist, Power & Carlson, 1995; Goodman & McGrath, 2003; Spagrud et al., 2008; Taylor, Sellick & Greenwood, 2011; Williams, Blount & Walker, 2011). Greater child and parent pain catastrophizing, anxiety, and distress are also implicated in these interactions, increasing the likelihood of maladaptive parent-child interactions during child pain and poorer pain outcomes (Caes, Vervoort, et al., 2014; Caes, Vervoort, Eccleston, Vandenhende & Goubert, 2011; Caes, Vervoort, Trost & Goubert, 2012; Link & Fortier, 2015; Vervoort et al., 2011; Williams et al., 2011).

Previous studies examining families in pediatric pain are limited by their primary reliance on self-report questionnaires from a single family member, and the lack of information about specific aspects of family functioning (Lewandowski et al., 2010). Children and parents often report differing perspectives of the family, which can also differ from observational assessment (Alderfer et al., 2008; Cohen, Manimala & Blount, 2000; Ginsburg, Siqueland, Masia-Warner & Hedtke, 2004; Holmbeck, Li, Schurman, Friedman & Coakley, 2002). Furthermore, family observation may have natural clinical applicability given increased ease of identifying specific behaviours for intervention (Kerig & Lindahl, 2001). Thus, use of multi-informant multi-method assessment of family functioning including child- and parent-report and family observation, as well as observation of parent-child interactions during child pain, offers high scientific rigour.

The objectives of this study were to explore relations between reported and observed family functioning and aspects of children's pain experience, including (a) child pain intensity, unpleasantness, and tolerance, (b) child and parent behaviours during child

pain, (c) child and parent dispositional vulnerability factors for poor coping, including trait anxiety and trait pain catastrophizing; and (d) child and parent situational coping, including distress and state pain catastrophizing. Considering previous research, we expected children and parents from healthier functioning families to report lower child pain intensity and unpleasantness, and higher pain tolerance, to engage in more adaptive parent-child interactions during pain (i.e., less pain-focused talk), to report lower trait anxiety and trait pain catastrophizing, and lower distress and state pain catastrophizing following child pain. If true, this may lead to identification of at-risk families who require targeted intervention in order to adaptively support children during pain. In this study, healthier family function was considered present in families reporting fewer problems, and displaying less conflict, anger/frustration, rejection, coerciveness, opposition/defiance, and withdrawal, and greater positive affect, cohesiveness, and emotional support (Alderfer et al., 2008; Lindahl & Malik, 2001; Skinner, Steinhauer & Santa-Barbara, 1995; Skinner, Steinhauer & Sitarenios, 2000).

3.3 METHODS

This paper is one of two empirical papers presenting unique research questions from a larger study. The current paper focuses on family functioning in children's experimental pain, while the second paper presents a dyadic analysis of child and parent pain catastrophizing in observed parent and child behaviours, and child pain outcomes (Birnie, Chambers, Chorney, Fernandez & McGrath, 2015b). Additional questionnaires and observations from a second parent-child interaction (i.e., a conflict discussion task) used to assess family functioning are presented here. The IWK Health Centre research ethics board approved this study.

3.3.1 Participants

A community-based sample of 171 dyads comprised of one child (8-12 years old) and a parent completed the study. Exclusion criteria for parents and children included difficulty reading, writing, or conversing in English, uncorrected vision or hearing impairments, or previous completion of the cold pressor task. Children were also excluded if they had a developmental delay or disability, or any contraindication to participation in the cold pressor task (von Baeyer, Piira, Chambers, Trapanotto & Zeltzer, 2005). An additional six dyads were excluded for not speaking English for at least half of one parent-child interaction ($n=4$), interaction was accidentally not recorded ($n=1$), or early withdrawal from the study ($n=1$).

Children had an average age of 10.03 years ($SD=1.38$). About half were girls ($n=89$; 52.0%) and most were White ($n=142$; 83.0%), followed by mixed race ($n=17$; 9.9%), Asian ($n=5$; 2.9%), Native/Aboriginal ($n=4$; 2.3%), Arab ($n=2$; 1.2%), Black ($n=1$; 0.6%), Latin American ($n=1$; 0.6%), or other ($n=1$; 0.6%). A small portion of children ($n=23$; 13.5%) had recurring pain (e.g., arthritis, headaches, back pain, abdominal pain), with very few ($n=2$; 1.2%) taking medication for pain more than once per week.

Parents had an average age of 41.23 years ($SD=6.01$). Most were mothers ($n=135$; 78.9%), married ($n=122$; 71.3%), had completed at least an undergraduate university degree ($n=105$; 61.4%), and reported an annual household income $> \$75,000$ CAD ($n=108$; 63.2%). Most parents were White ($n=147$; 85.9%), followed by mixed race ($n=8$; 4.7%), Asian ($n=6$; 3.5%), Native/Aboriginal ($n=3$; 1.8%), Black ($n=2$; 1.2%), Arab ($n=2$; 1.2%), or other ($n=3$; 1.8%). Parent-child dyads were mostly mother-daughter

($n=72$; 42.1%) or mother-son ($n=65$; 38.0%), followed by father-daughter ($n=17$; 9.9%) and father-son ($n=17$; 9.9%). The majority of dyads lived together all of the time ($n=146$; 85.4%), with only three dyads (1.8%) residing together less than 50% of the time.

3.3.2 Observed Parent-Child Interactions

Cold Pressor Task (CPT)

The CPT is a commonly used and ethically acceptable experimental method of inducing pain in children (Birnie, Noel, Chambers, von Baeyer & Fernandez, 2011; Birnie, Petter, Boerner, Noel & Chambers, 2012). Children immersed their non-dominant hand to the wrist in $10\pm 1^{\circ}\text{C}$ water for up to an uninformed maximum of four minutes. They were instructed to keep their hand immersed as long as they could, but that they could remove their hand at any time if it became too uncomfortable or hurt too much. The CPT was selected over other experimental pain tasks as it lasts up to several minutes, offering adequate time to observe parent-child interactions (Birnie, Caes, Wilson, Williams & Chambers, 2014; Moon, Chambers & McGrath, 2011).

Parent and child verbalizations during the CPT were transcribed verbatim and coded into mutually exclusive and exhaustive codes consistent with previous research (Moon et al., 2011). Parent verbalizations were classified into three broad categories: Attending Talk, Non-Attending Talk, or Other Talk. (1) Parent Attending Talk comprised four subcodes, including symptom-focused talk and commands to child, sympathy to child, procedure-related praise to child, and procedure time talk and commands to child. (2) Parent Non-Attending Talk comprised two subcodes, including nonsymptom-focused talk and commands to child, and humour to child. (3) Parent Other Talk comprised three subcodes, including other procedure talk and commands to child, criticism to child, and

other talk to child (e.g., ‘what did you say?’). Child verbalizations were classified into two broad categories: Symptom Complaints or Other Talk. (1) Child symptoms complaints comprised four subcodes, including cold/pain symptom talk to parent, anxiety talk to parent, procedure time talk to parent, and resistance talk to parent. (2) Child Other Talk comprised three subcodes, including other procedure talk to parent, child coping talk to parent, and other talk to parent (e.g., ‘what are you doing?’). Coding began when the child first immersed their hand in the water and ended when the child’s pain tolerance was reached (i.e., the child removed their hand from the water) or when 90 seconds had elapsed, whichever came first. Ninety seconds was chosen as the maximum coding end point given the bimodal distribution of pain tolerance consistently observed in CPT studies in this age range (Birnie, Parker & Chambers, 2014; Birnie et al., 2012). In the current study, just over half (51.5%) of children reached pain tolerance before 90 seconds, with all but three (1.2%) of the remaining children reaching the four minute pain tolerance ceiling. A primary coder coded all parent-child interactions with a random selection of 20% of the videos additionally coded by the first author. Interrater agreement was excellent (Fleiss, Levin, & Cho Paik, 2003), with kappa statistics of .823 ($SE=.01$) for parent subcodes (.855; $SE=.01$ for broad categories) and .841 ($SE=.02$) for child subcodes (.863; $SE=.02$ for broad categories). Proportional scores for each parent and child category were used in all analyses and were obtained by dividing the number of verbalizations in each category by the total number of verbalizations.

Conflict Discussion Task

As an observational assessment of family functioning, parents and children completed a second interaction task requiring them to discuss a topic or topics about

which they frequently argue or disagree. Prior to the task, children and parents separately selected up to three items from the *Issues Checklist* (Robin & Foster, 1989), outlining topics about which children and parents often disagree (e.g., bedtime, fighting with siblings, talking back to parents). Children and parents could add additional topics if desired. Following approaches taken in previous research, these items were used to guide the conflict discussion task (DeLambo, Ievers-Landis, Drotar & Quittner, 2004), with the item rated most conflictual and agreed upon by both the parent and child chosen for the first topic of discussion (Donenberg & Weisz, 1997). If no items were rated by both the parent and child as conflictual, then the topic rated as most conflictual by the parent was selected, and so on until three items were identified. Children and parents were instructed to discuss for a full five minutes, with the goal of trying to reach an agreement or solve each conflict. If an agreement was reached about the first topic, then they were directed to move on to the second and third topics as needed.

Family functioning during the conflict discussion task was assessed using the System for Coding Interactions and Family Functioning (SCIFF) (Lindahl & Malik, 2000). This global coding system was designed to code family problem discussions and was originally evaluated for interactions with two parents and one child between 7-12 years of age (Lindahl & Malik, 2001), with a modified version available for interactions between one parent and one child (Lindahl & Malik, 2000). A goal of the coding system is to identify observable behavioural patterns of family functioning that are important to child outcomes. The SCIFF contains codes at the level of the family, as well as the parent and child. Five family-level codes include: Negativity/Conflict, Positive Affect, Cohesiveness, Focus of Problem (child versus family), and Parenting Style. Four parent

codes include: Rejection & Invalidation, Coerciveness, Emotional Support, and Withdrawal. Five child codes include: Anger & Frustration, Sadness & Distress, Withdrawal, Opposition/Defiance, and Positive Affect. Each code is rated on a 5-point Likert scale from 1 'very low' to 5 'high' for the entire five-minute interaction, with the exception of Parenting Style, for which coders select one of four possible categories, including Democratic, Hierarchical/Autocratic, Lax, or Inconsistent. To guide rating selection, specific definitions are provided for each code overall, as well as for each level of each code. Definitions include both verbal and nonverbal elements of communication.

Previous evaluation of the SCIFF demonstrated satisfactory to excellent interrater reliability (.65-.80 Pearson correlations) with mixed ethnicity families (Lindahl & Malik, 2001) and have demonstrated validity with self-report measures of family functioning and marital satisfaction (Alderfer et al., 2008; Lindahl & Malik, 2001). The SCIFF has been used previously in research examining disruptive behaviour in children (Lindahl, 1998; Lindahl & Malik, 1999), and the impact of parental conflict on children (DeBoard-Lucas, Fosco, Raynor & Grych, 2010; Kitzmann, 2000). The SCIFF was given a rating of "approaching well-established" in a recent review of family measures in pediatric psychology, largely due to its limited use in published research to date (Alderfer et al., 2008).

The coding process for the current study was informed by recommendations from developers of the SCIFF (Lindahl & Malik, 2000; 2001) and for coding behavioural observations generally (Chorney, McMurtry, Chambers & Bakeman, 2015; Yoder & Symons, 2010). The primary coder was a research assistant at the graduate level who received training from the first author in use of the SCIFF. After reviewing the coding

manual in detail, the coder coded eight parent-child interactions for training purposes. Three parent-child interactions were taken from a similar study from the same research center, which used the same conflict discussion task, with an additional five randomly selected videos from the current study. Ratings were compared and discussed with the first author until adequate reliability was achieved (i.e., within one point of the first author on the rating scale). To assess interrater reliability, the primary author coded a randomly selected 20% of the videos different from those used for training purposes. Two statistical methods were used to assess interrater agreement for all continuous codes. As per the original SCIFF manual, Pearson correlations were calculated. Intraclass correlations were also calculated as they are considered a more rigorous estimate of interrater agreement (Mitchell, 1979; Shrout & Fleiss, 1979). Correlation coefficients were as follows: Family Negativity/Conflict ($r=.825$; $ICC=.795$), Family Positive Affect ($r=.620$; $ICC=.579$), Family Cohesiveness ($r=.714$; $ICC=.712$), Family Focus of Problem ($r=.757$; $ICC=.747$), Parent Rejection & Invalidation ($r=.585$; $ICC=.513$), Parent Coerciveness ($r=.476$; $ICC=.406$), Emotional Support ($r=.655$; $ICC=.661$), and Parent Withdrawal ($r=.062$; $ICC=.045$), Child Anger & Frustration ($r=.836$; $ICC=.832$), Child Sadness & Distress ($r=.234$; $ICC=.219$), Child Withdrawal ($r=.681$; $ICC=.673$), Child Opposition/Defiance ($r=.883$; $ICC=.886$), and Child Positive Affect ($r=.752$; $ICC=.757$). Kappa was calculated for the categorical code of Parenting Style and was .284. Intraclass correlation coefficients of $>.5$ are considered ‘acceptable’ with $>.7$ considered ‘very good’ (Mitchell, 1979). Given their low interrater agreement, the following four codes were dropped from further consideration: Parenting Style, Parent Coerciveness, Parent Withdrawal, and Child Sadness & Distress.

3.3.3 Self-Report Measures

Family Functioning

Parents and children completed the Brief FAM: General Scale (Skinner et al., 1995) to provide an assessment of family functioning from both the child and the parent's perspective. The Brief FAM is a self-report measure of general family functioning adapted from the Family Assessment Measure III (Skinner et al., 2000), which is a "well-established" measure of family functioning with good reliability and predictive validity (Alderfer et al., 2008). Using the same version of the scale, parents and children rated each item of the 14-item measure on a 4-point scale from 'strongly agree' to 'strongly disagree', yielding a single total score. Higher scores indicate poorer family functioning. The Brief FAM is based on the process model of family functioning, which identifies the primary goal of the family to be the accomplishment of basic, developmental, and/or crisis tasks. Task accomplishment is achieved by high functioning families who successfully identify specified family roles, communicate effectively, appropriately express emotion, are involved with one another, and balance flexibility and control (Skinner et al., 2000). Cronbach's alphas in the current study were .85 and .74 for parents and children, respectively.

Child Pain Outcomes

Parents and children rated child pain intensity using the Faces Pain Scale-Revised (FPS-R) (Hicks, von Baeyer, Spafford, van Korlaar & Goodenough, 2001). The FPS-R is a reliable and well-validated measure recommended for self-reported pain in children of this age range (Stinson, Kavanagh, Yamada, Gill & Stevens, 2006), and used by parents to provide proxy ratings of children's pain (Boerner, Chambers, Craig, Pillai Riddell &

Parker, 2013; Boerner et al., 2015). Parents and children rated child pain unpleasantness using an 11-point numeric rating scale from 0 ‘not at all unpleasant/horrible/yucky’ to 10 ‘most unpleasant/horrible/yucky’ (Pagé et al., 2011). This measure has shown good validity when used by children and adolescents for acute pain (Pagé et al., 2011; Pagé et al., 2012). Child pain tolerance was considered the number of seconds that the child’s hand was immersed in the water during the CPT up to a maximum of four minutes (i.e., 240 seconds).

Pain Catastrophizing

Parents and children completed trait versions of the Pain Catastrophizing Scale for children (PCS-C) (Crombez et al., 2003) and for parents (PCS-P) (Goubert et al., 2006). Both scales assess catastrophic thoughts about child pain generally and include 13-items that comprise three subscales of rumination, magnification, and helplessness. Each item is responded to on a 5-point Likert scale with higher scores indicating higher levels of pain catastrophizing. Good validity for both parent and child versions has been shown with both community and chronic pain samples of children (Crombez et al., 2003; Goubert et al., 2006; Parkerson et al., 2013). Cronbach’s alpha of the trait PCS-P and the PCS-C in the current study were .92 and .89, respectively.

Parents and children also completed state versions of these measures, which assess catastrophic thoughts specific to the cold pressor task. As compared with trait pain catastrophizing, which has been conceptualized as a dispositional vulnerability to poor pain coping, state pain catastrophizing is considered to have a more direct role in poor coping responses to pain, and appears more strongly related to acute and experimental pain responding (Campbell et al., 2010; Sturgeon & Zautra, 2013a). State versions of the

scales include 6 items (2 from each subscale) that are responded to on an 11-point numeric rating scale with higher scores indicating higher levels of state pain catastrophizing. State versions of the PCS-P and PCS-C have been used in previous studies of children's acute clinical and experimental pain (Boerner et al., 2015; Caes et al., 2011; Vervoort, Goubert, Eccleston, et al., 2009; Vervoort, Goubert, et al., 2011). Cronbach's alphas of the state PCS-P and PCS-C in the current study were .76 and .79, respectively.

Trait Anxiety

Children completed the Screen for Child Anxiety Related Emotional Disorders (SCARED) (Birmaher et al., 1999) as a measure of their trait anxiety. The SCARED was developed as a screening tool for childhood anxiety disorders and is comprised of 41 items that reflect various symptoms of anxiety. Each item is scored on a 3-point scale from 0 'not true or hardly ever true' to 2 'very true or often true'. Subscale scores corresponding to specific childhood anxiety disorders can be obtained, although only the total score was considered in this study. Higher scores indicate higher levels of trait anxiety with a maximum total score of 82. The SCARED has excellent reliability and validity with clinically anxious and nonclinical samples of children and adolescents (Birmaher et al., 1999; Hale, Raaijmakers, Muris & Meeus, 2005; Monga et al., 2000). Cronbach's alpha for the SCARED in the current study was .86.

Parents completed the Beck Anxiety Inventory (BAI) (Beck & Steer, 1993) as a measure of their trait anxiety. The BAI is comprised of 21 items that reflect various symptoms of anxiety. Each item is scored on a 4-point scale from 0 'not at all' to 3 'severely' indicating how much the individual has been bothered by that symptom during

the past week. Higher scores indicate higher levels of trait anxiety with a maximum score of 63. The BAI has excellent reliability and validity as demonstrated with both clinically anxious and nonclinical samples of adults (Beck & Steer, 1993; Creamer, Foran & Bell, 1995). Cronbach's alpha for the BAI in the current study was .86.

Situational Distress

As a measure of their distress following the CPT, children completed the children's distress questionnaire. This measure was created for the current study as a multi-faceted assessment of child distress comprised of five items: worried, nervous, sad, uncomfortable, and mad. Children rate each item on an 11-point numeric rating scale indicating to what extent they are experiencing each emotion from 0 'not at all worried/nervous/sad/uncomfortable/mad' to 10 'most worried/nervous/sad/uncomfortable/mad'. A mean score is calculated with higher scores indicate greater distress. Cronbach's alpha for the children's distress questionnaire was .78.

As a measure of their situational distress following the CPT, parents completed the parent distress and sympathy questionnaire used in previous research to assess parental distress in response to children's pain (Caes, Vervoort, et al., 2014; Caes et al., 2011; Goubert, Vervoort, Sullivan, Verhoeven & Crombez, 2008). On an 11-point numeric rating scale from 0 'not at all' to 10 'extremely', parents rate the extent to which they are experiencing the following seven emotions: worried, understanding, upset, compassionate, anxious, sympathizing, and sad. Two subscale scores can be derived: self-oriented (worried, upset, anxious, and sad) and other-oriented distress (understanding, compassionate, and sympathizing). Mean scores are calculated for each

subscale with higher scores indicate greater distress. Only the self-oriented distress scale is reported in this study as it mirrors self-oriented distress assessed in children.

Cronbach's alpha for the self-oriented situational distress scale was .92.

Typicality of Others' Behaviour

To assess ecological validity of parent-child interactions, parents and children rated how different the others' behaviour was during the lab-based interactions tasks as compared to how they usually act in similar circumstances (Walker et al., 2006).

Responses were rated on a 5-point scale ranging from 0 'not at all different than usual' to 4 'a whole lot different than usual'. On average, children and parents' rated the others' behaviour close to 'a little different than usual' ($M=.93$ ($SD=1.03$) and $M=.92$ ($SD=1.08$) for parent behaviour during conflict discussion task and CPT, respectively; $M=1.25$ ($SD=1.04$) and $M=1.01$ ($SD=1.02$) for child behaviour during conflict discussion task and CPT, respectively).

3.3.4 Procedure

After providing consent/assent, parents and children completed measures of trait pain catastrophizing, trait anxiety, and demographics. Dyads were then randomly assigned to complete the conflict discussion task or CPT in counterbalanced order. After completion of the CPT, parent and children rated their situational distress and state pain catastrophizing, as well as the child's pain intensity and pain unpleasantness. Prior to being debriefed by a research assistant, parents and children rated the typicality of the others' behaviour for both tasks and a sentence completion task, which asked them to reflect on what they liked most about each other. This was included to minimize any residual negative impact of study participation. Upon debriefing, parents were given a

handout summarizing evidence-based parent responses associated with minimized child pain and distress during acute painful experiences.

3.3.5 Data Analysis

Associations between study variables and child age, child sex, parent sex, and task order were examined using correlations and independent samples t-tests as appropriate. This was done with the intent of identifying any covariates that should be controlled for in subsequent analyses.

An actor-partner interdependence model (APIM) was used to assess the influence of child- and parent-reported family functioning on child and parent ratings of child pain intensity and pain unpleasantness, trait anxiety, trait and state pain catastrophizing, and situational distress (Cook & Kenny, 2005; Kenny, Kashy & Cook, 2006). APIM is a multilevel statistical modeling technique that accounts for the non-independence of data derived from dyads. It is used to test for interpersonal effects and, as such, is ideally suited for examining potential interpersonal influences within parent-child dyads. APIM analyses estimate actor and partner effects for both children and parents. A significant actor effect indicates an intrapersonal relation between the respondent's own predictor and outcome; whereas a significant partner effect indicates an interpersonal relation between a respondent's predictor (e.g., child) and the other respondent's outcome (e.g., parent). APIM also tests for significant differences in the size of actor or partner effects between respondents (child or parent). APIM has been previously applied to examine dyads of youth with chronic pain and their parents (Fales et al., 2014) and children with cystic fibrosis and their caregivers (Driscoll, Schatschneider, McGinnity & Modi, 2012).

A series of hierarchical multiple regressions were used to examine the influence

of child- and parent-reported family functioning on child pain tolerance, and observed parent and child behaviours during child pain. In each case, relevant covariates were entered in Step 1, followed by child- and parent-reported family functioning separately in Step 2, and their interaction in Step 3. Hierarchical multiple regressions were also used for all analyses examining the influence of observed family functioning. Any identified covariates were entered in Step 1 and observed family functioning codes in Step 2. Correlations between SCIFF codes were all $< .70$ suggesting no concerns with multicollinearity (Tabachnick & Fidell, 2001).

3.4 RESULTS

3.4.1 Relations with Demographics and Procedural Variables

See Table 3.1 for means, standard deviations, and ranges of self-reported study variables and observed family functioning. Table 3.2 reports correlations between reported and observed family functioning. Most parents and children reported family functioning in the average to excellent range, with 7.0% ($n=12$) of parents and 10.5% ($n=18$) of children reporting scores in the ‘increasing problems’ to ‘problematic’ range (Skinner et al., 1995). Children reported a range of low ($n=58$; 33.9%), moderate ($n=49$; 28.7%), and high ($n=64$; 37.4%) levels of trait pain catastrophizing (Pielech et al., 2014), and just over one third of children (24.5%; $n=59$) reported trait anxiety in a clinically significant range (Birmaher et al., 1999).

Older children reported significantly less distress following the CPT ($r=-.198$, $p<.01$) and greater pain tolerance ($r=.268$, $p<.01$), as well as fewer symptom complaints ($r=-.246$, $p<.01$) and more other talk ($r=.268$, $p<.01$) when interacting with their parents during the CPT. Some significant associations were noted between child age and

observed family functioning, with older children displaying greater anger and frustration ($r=.183, p<.05$) and less positive affect ($r=-.172, p<.05$). No other significant relations were observed with child age. Child age was controlled for in all analyses involving child distress, child pain tolerance, parent-child interactions during the CPT, and observed family functioning.

Observed family functioning also differed significantly between parent-child dyads with girls versus boys. Family cohesiveness was significantly higher for dyads with girls as compared with boys ($M=3.55; SD=1.09$ versus $M=3.06; SD=1.07; t=-2.97, p<.01$). Girls also had significantly greater observed positive affect ($M=2.53; SD=1.23$ versus $M=2.00; SD=.99; t=3.32, p<.01$), and significantly lower observed withdrawal ($M=1.91; SD=1.07$ versus $M=2.51; SD=1.23; t=-3.11, p<.01$). No other sex differences were noted for children. Fathers reported significantly poorer family functioning as compared with mothers ($M=11.22; SD=4.75$ versus $M=9.15; SD=4.80; t=-2.31, p<.05$), and no other significant differences were noted between mothers and fathers. Children reported significantly poorer family functioning than parents ($M=13.06; SD=5.06$ vs. $M=9.58; SD=4.85; t=-6.48, p<.01$), and child and parent reports of family functioning were not significantly related ($r=.135, ns$). Therefore, child sex was controlled for in all analyses involving observed family functioning, and parent sex was controlled for in analyses involving parent and child-reported family functioning.

With regards to task order, 93 dyads (54.4%) completed the CPT first, with 78 dyads (45.6%) completing the conflict discussion task first. Children who completed the CPT second had significantly higher state pain catastrophizing ($M=18.04; SD=12.62$ vs. $M=14.09; SD=10.79; t=-2.21, p<.05$) and higher pain intensity ($M=5.08; SD=3.02$ vs.

$M=4.19$; $SD=2.80$; $t=-1.98$, $p<.05$). As such, task order was controlled for in subsequent analyses involving these variables.

3.4.2 Objective A: Family Functioning and Child Pain Outcomes

Self-Report of Family Functioning

Controlling for parent sex and task order, no significant actor effects were observed for children ($\beta=-.041$, *ns*) or parents ($\beta=-.072$, *ns*) for ratings of child pain intensity. No significant partner effects were observed, such that neither parent- ($\beta=-.167$, *ns*) nor child-reported ($\beta=-.029$, *ns*) family functioning influenced the others' ratings of the child's pain intensity. Controlling for parent sex, no significant actor effects were observed for children ($\beta=-.050$, *ns*) or parents ($\beta=.009$, *ns*) for ratings of child pain unpleasantness, and neither parent- ($\beta=-.163$, *ns*) nor child-reported ($\beta=.030$, *ns*) family functioning influenced the others' ratings.

A hierarchical regression examined the impact of reported family functioning on children's pain tolerance. Covariates of child age and parent sex accounted for 7.2% of the variance (Step 1: $R=.268$; $F(2,168)=6.50$, $p<.01$), with only child age as a significant predictor ($\beta=.268$, $p<.01$). Neither child nor parent-reported family functioning (Step 2: $\Delta R^2=.003$, *ns*), nor their interaction (Step 3: $\Delta R^2=.004$, *ns*), added significantly, although the final model remained significant ($R=.280$; $F(5,165)=2.82$, $p<.05$).

Observed Family Functioning

Neither child ($R=.289$; $F(13,157)=1.10$, *ns*) nor parent ratings ($R=.238$; $F(12,158)=.788$, *ns*) of child pain intensity were significantly predicted. Similarly, neither child ($R=.282$; $F(12,158)=1.14$, *ns*) nor parent ratings ($R=.196$; $F(12,158)=.528$, *ns*) of child pain unpleasantness were significantly predicted. Covariates accounted for 7.8% of

variance in child pain tolerance (Step 1: $R=.298$; $F(2,168)=8.16$, $p<.01$), with only child age as a significant predictor ($\beta=.280$, $p<.01$). Observed family functioning did not add significantly (Step 2: $\Delta R^2=.058$, ns), although the final model remained significant ($R=.383$; $F(12,158)=2.26$, $p<.05$).

3.4.3 Objective B: Family Functioning and Observed Behaviours During Child Pain

Self-Report of Family Functioning

Child Behaviours

Child age and parent sex accounted for 6.2% of variance in child symptom complaints (Step 1: $R=.249$; $F(2,168)=5.55$, $p<.01$), with only child age as a significant predictor ($\beta=-.244$, $p<.01$). Neither child- nor parent-reported family functioning (Step 2: $\Delta R^2=.002$, ns), nor their interaction (Step 3: $\Delta R^2=.001$, ns) added significantly, although the final model remained significant ($R=.255$; $F(5,165)=2.29$, $p<.05$). Child age and parent sex accounted for 7.3% of variance in child other talk (Step 1: $R=.270$; $F(2,168)=6.58$, $p<.01$), with only child age as a significant predictor ($\beta=.267$, $p<.01$). Neither child- nor parent-reported family functioning (Step 2: $\Delta R^2=.000$, ns), nor their interaction (Step 3: $\Delta R^2=.000$, ns) added significantly, although the final model remained significant ($R=.271$; $F(5,165)=2.61$, $p<.05$).

Parent Behaviours

Parent pain attending talk was not significantly predicted by covariates or by reported family functioning ($R=.181$; $F(5,165)=1.11$, ns). Child age and parent sex accounted for 6.8% of variance in parent non-attending talk (Step 1: $R=.261$; $F(2,168)=6.15$, $p<.01$), with only child age as a significant predictor ($\beta=.252$, $p<.01$). Neither child- nor parent-reported family functioning (Step 2: $\Delta R^2=.001$, ns), nor their

interaction (Step 3: $\Delta R^2=.002$, *ns*) added significantly, although the final model remained significant ($R=.268$; $F(5,165)=2.55$, $p<.05$). Child age and parent sex accounted for 4.9% of variance in parent other talk (Step 1: $R=.221$; $F(2,168)=4.32$, $p<.05$), with only child age as a significant predictor ($\beta=-.216$, $p<.01$). Neither child- nor parent-reported family functioning (Step 2: $\Delta R^2=.002$, *ns*), nor their interaction (Step 3: $\Delta R^2=.002$, *ns*) added significantly, and the final model was not significant ($R=.230$; $F(5,165)=1.84$, *ns*).

Observed Family Functioning

Child Behaviours

Child age and sex accounted for 6.0% of variance in child symptom complaints (Step 1: $R=.246$; $F(2,168)=5.40$, $p<.01$), with only child age as a significant predictor ($\beta=-.245$, $p<.01$). Observed family functioning added significantly (Step 2: $\Delta R^2=.137$, $p<.01$), with the final model accounting for 19.8% of variance ($R=.445$, $F(12,158)=3.24$, $p<.01$). Family negativity and conflict ($\beta=-.243$, $p<.05$), family cohesiveness ($\beta=-.319$, $p<.01$), family focus of the problem ($\beta=.191$, $p<.05$), and parent emotional support ($\beta=.285$, $p<.01$) were significant predictors. Child age and sex accounted for 7.2% of variance in child other talk (Step 1: $R=.268$; $F(2,168)=6.52$, $p<.01$), with only child age as a significant predictor ($\beta=.269$, $p<.01$). Observed family functioning added significantly (Step 2: $\Delta R^2=.120$, $p<.05$), with the final model accounting for 13.1% of variance ($R=.439$, $F(12,158)=3.14$, $p<.01$). Family cohesiveness ($\beta=.285$, $p<.01$), family focus of the problem ($\beta=-.180$, $p<.05$), and parent emotional support ($\beta=-.264$, $p<.01$) were significant predictors.

Parent Behaviours

Neither child age and sex (Step 1: $R=.126$; $F(2,168)=1.36$, *ns*) nor observed

family functioning (Step 2: $R=.329$; $F(12,158)=1.60$, *ns*) predicted parent pain attending talk. Child age and sex accounted for 6.9% of variance in parent non-attending talk (Step 1: $R=.262$; $F(2,168)=6.18$, $p<.01$), with only child age as a significant predictor ($\beta=.260$, $p<.01$). Observed family functioning did not predict parent non-attending talk (Step 2: $\Delta R^2=.067$, *ns*), although the final model remained significant ($R=.369$; $F(12,158)=2.07$, $p<.05$). Child age and sex accounted for 4.6% of variance in parent other talk (Step 1: $R=.215$; $F(2,168)=4.08$, $p<.05$), with only child age as a significant predictor ($\beta=-.213$, $p<.01$). Observed family functioning did not predict parent other talk (Step 2: $\Delta R^2=.040$, *ns*), and the final model was not significant ($R=.294$; $F(12,158)=1.24$, *ns*).

3.4.4 Objective C: Family Functioning, Trait Anxiety, and Trait Pain

Catastrophizing

Self-Report of Family Functioning

See Figure 3.1 for the APIM model of family functioning and trait anxiety and pain catastrophizing. Controlling for parent sex, significant actor effects were observed for children ($\beta=.271$, $p<.01$) and parents ($\beta=.133$, $p<.01$) for trait anxiety, indicating that poorer family functioning as reported by children or parents predicted increased ratings of their own trait anxiety. No significant partner effects were observed for children ($\beta=-.077$, *ns*) or for parents ($\beta=.046$, *ns*). No significant actor or partner by respondent interactions were found ($\beta=-.069$, *ns* and $\beta=.062$, *ns*, respectively).

A similar pattern of results was observed for trait pain catastrophizing. Significant actor effects were observed for children ($\beta=.244$, $p<.01$) and parents ($\beta=.192$, $p<.05$), indicating that poorer child- or parent-reported family functioning predicted increased levels of their own trait pain catastrophizing. No significant partner effects were observed

for children ($\beta=-.049$, *ns*) or for parents ($\beta=.011$, *ns*), and no significant actor or partner by respondent interactions ($\beta=-.026$, *ns* and $\beta=.030$, *ns*, respectively).

Observed Family Functioning

Neither child ($R=.243$; $F(12, 158)=.829$, *ns*) nor parent ($R=.217$; $F(12, 158)=.651$, *ns*) trait anxiety were significantly predicted by covariates of child sex and age, and observed family functioning. Similarly, neither child ($R=.178$; $F(12, 158)=.432$, *ns*) nor parent ($R=.252$; $F(12, 158)=.893$, *ns*) trait pain catastrophizing were significantly predicted by covariates of child sex and age, and observed family functioning.

3.4.5 Objective D: Family Functioning, Situational Distress, and State Pain

Catastrophizing

Self-Report of Family Functioning

Controlling for child age and parent sex, a significant actor effect for parents was observed ($\beta=.301$, $p<.01$), such that parents who reported poorer family functioning experienced greater situational distress following the CPT. No significant actor effect was observed for children ($\beta=.064$, *ns*). A significant respondent by actor effect interaction was observed indicating that the relation between reported family functioning and situational distress was stronger for parents than for children ($\beta=.118$, $p<.05$). No significant partner effects were observed for parents ($\beta=.020$, *ns*) or children ($\beta=-.141$, *ns*).

Controlling for task order, no significant actor effects were observed for children ($\beta=.055$, *ns*) or parents ($\beta=.055$, *ns*) for child and parent state pain catastrophizing. No significant partner effects were observed for children ($\beta=-.107$, *ns*) or parents ($\beta=.023$, *ns*).

Observed Family Functioning

Covariates of child sex and age accounted for 4.2% of variance in child situational distress (Step 1: $R=.206$; $F(2, 168)=3.71$, $p<.05$), with child age as the only significant predictor ($\beta=-.203$, $p<.01$). Observed family functioning did not add significantly (Step 2: $\Delta R^2=.056$, *ns*), and the final model was not significant ($R=.313$; $F(12, 158)=1.43$, *ns*). Parent situational distress was not significantly predicted ($R=.212$; $F(12, 158)=.622$, *ns*).

Neither child ($R=.297$; $F(13, 157)=1.17$, *ns*) nor parent ($R=.266$; $F(12, 158)=.999$, *ns*) state pain catastrophizing were significantly predicted by covariates of child age, child sex, and task order, and observed family functioning.

3.5 DISCUSSION

To our knowledge, this is the first study to apply a multi-informant multi-method research design and dyadic data analysis to examine relations between family functioning and children's pain. In doing so, it addresses significant methodological limitations of previous work in pediatric pain (Lewandowski et al., 2010). In general, few expected associations were found between family functioning and aspects of children's pain. Significant findings relating family functioning to parent and child trait pain catastrophizing and trait anxiety, parent situational distress, and child pain behaviours, contribute new information to our understanding of the role of families in child pain.

Poorer family functioning as reported by children and parents predicted greater ratings of children's and parents' own trait anxiety and catastrophizing about child pain, with no evidence of interpersonal influence of perceived family functioning on the other's anxiety or pain catastrophizing. These results are clinically meaningful for children in particular as they indicate that increases in average child-reported family

functioning from the ‘average’ to the ‘increasing problems’ range on the Brief FAM would result in clinically significant increases in average levels of child trait anxiety and trait pain catastrophizing. More specifically, child trait anxiety would rise above clinical reference points discriminating children with anxiety disorders from those without (Birmaher et al., 1999), and children’s average trait pain catastrophizing would rise from moderate to high levels (Pielech et al., 2014). Mean child-reported family functioning in this study was comparable to that reported by adolescents with chronic pain (Gauntlett-Gilbert & Eccleston, 2007). Although modest in size, the significant findings relating parent-reported family functioning to parent anxiety and pain catastrophizing are worth noting given the generally low levels of parent anxiety and pain catastrophizing observed. Furthermore, it is notable to see these relations in a community-based sample of children and parents, as previous evidence showing poorer family functioning amongst highly anxious or high pain catastrophizing children or parents, is largely drawn from samples with diagnosed anxiety disorders (Bögels & Brechman-Toussaint, 2006) or chronic pain (Gauntlett-Gilbert & Eccleston, 2007; Jastrowski Mano et al., 2011).

Although this study was cross-sectional, APIM analyses implied directionality from poorer family functioning to worse anxiety and pain catastrophizing. This is consistent with the conceptualization of trait anxiety and pain catastrophizing as dispositional vulnerabilities to poor pain adaptation learned and enacted within a longstanding family context (Goubert et al., 2011; Kliwer et al., 1994). However, it is also possible that family dysfunction arises as an interpersonal consequence of high anxiety and pain catastrophizing. The directionality or potential bi-directionality of these associations remains unclear due to the largely cross-sectional nature of existing research

(Bögels & Brechman-Toussaint, 2006; Lewandowski et al., 2010). Given that observed family functioning did not predict child or parent trait anxiety or pain catastrophizing, these results could also reflect a tendency of individuals who report more anxious and catastrophic thoughts to also perceive greater family problems.

Minimal expected associations were found between family functioning and child or parent situational coping with child pain, with only poorer parent-reported family functioning predicting greater parent distress. This informs existing theories of empathy for others' pain by identifying a relevant contextual factor impacting parents' affective responses to child pain (Goubert et al., 2005). Although levels of parent distress were minimal and lower than reported during child clinical acute pain, this finding is worth highlighting for further research as higher parent self-oriented distress is strongly implicated in greater maladaptive parent responses to child pain, which contribute to increased pain and distress for children (Caes, Vervoort, et al., 2014; Caes et al., 2011). This study identifies a family-level contributor to parent distress, in addition to more widely discussed parent-level factors, such as pain catastrophizing (Caes, Goubert, et al., 2014).

Children engaged in more pain symptom complaints when they were from families that displayed lower negativity/conflict and cohesiveness, and greater parent emotional support and family-centered (versus child-only) understanding of family problems. Children from families with greater cohesiveness, less parent emotional support, and more child-centered understanding of family problems engaged in more other talk during pain, such as coping statements, talk related to practicalities of the CPT procedure, or unrelated topics. Overall, these findings add to the growing empirical

evidence that children's expressions of pain are influenced by factors beyond experienced pain intensity, particularly their social environment (Hadjistavropoulos et al., 2011).

With the exception of cohesiveness, the pattern of results suggests that children from generally healthier functioning families are engaging in greater pain behaviours. It could be that children from families with less negativity/conflict and greater parent emotional support feel more comfortable and safe expressing pain to their parent (Zimmer-Gembeck & Locke, 2007). Lower cohesiveness may have also fostered more open expression of child pain, as higher levels of cohesiveness have been associated with greater fear of negative evaluation amongst highly anxious children (Bögels & Brechman-Toussaint, 2006). However, the adaptive role of family cohesiveness in children's coping with pain may have been more clearly captured by its relation to other talk by children during the CPT. Greater family cohesiveness predicted more other talk by children, which encompasses a subcode of coping statements made by children during pain. Likely a moderate amount of cohesiveness is most adaptive as extremely high levels can indicate overdependence within parent-child relationships, which is related to poorer disability and pain amongst children with chronic pain (Logan & Scharff, 2005; Logan, Guite, Sherry & Rose, 2006).

Interestingly, greater family-centered understanding of family problems also predicted greater child symptom complaints. A higher score on this code is given when parents were observed describing multiple family members as contributing to and responsible for problems in the family, as opposed to attributing conflict solely to the individual child (Lindahl & Malik, 2000; 2001). This could reflect a "communal coping" approach to managing the stress of pain within the context of a close relationship. The

communal coping model specifies that conceptualizing stressors as “our” problem, communicating about them, and taking cooperative action to handle them, may underlie the resilience of families to cope with stressful experiences (Lyons, Mickelson, Sullivan & Coyne, 1998). In explaining a positive association between healthier family functioning and increased reported pain, a review in pediatric chronic pain suggested that pain experiences may unite parents and children, and that a positive family environment may increase parent responsiveness to children’s pain (Lewandowski et al., 2010). A similar process of conceptualizing pain as “our” versus “your” problem may account for the current study’s findings. This is also consistent with greater parent emotional support predicting greater child symptom complaints. It is, however, inconsistent with a study reporting associations between poorer, not healthier family functioning and a greater parental sense of responsibility for children’s chronic pain (Guite et al., 2009). A communal coping model specific to pain has also been developed, although it primarily attributes greater pain behaviours to higher levels of trait pain catastrophizing (Sullivan, 2012), which was associated with poorer perceived family functioning in the current study. This suggests a more complex picture warranting additional research. An important caveat when interpreting this study’s significant results involving child behaviours is that overall, observed family functioning accounted for a relatively small amount of variance in children’s symptom complaints (13.8%) and child other talk (5.9%). Thus, the family context likely plays a much smaller role in children’s behaviours during pain than other established factors, such as parent coaching (Williams et al., 2011) or modeling (Goodman & McGrath, 2003). Observed family functioning did not predict parent behaviours during child pain, and neither parent nor child behaviours were

predicted by reported family functioning.

Unexpectedly, no associations were found between family functioning and child pain outcomes from the CPT as rated by children or parents. Some studies in pediatric chronic pain have found significant relations between aspects of family functioning and experienced pain (Logan et al., 2006; Ross et al., 1993; Schanberg, Keefe, Lefebvre, Kredich & Gil, 1998), while others have not (Guite et al., 2009; Lewandowski & Palermo, 2009). It is possible that the family context is a more proximal influence in the experience of chronic pain, where pain is dealt with on a frequent and recurring basis. In conjunction with other findings from the current study, the overall impression is that family functioning may not directly shape the experience of child pain, but rather shapes parent and child coping tendencies and responses to that experience, particularly for families who generally do not experience recurrent pain.

Clinically, this study's findings indicate that greater family problems should prompt clinicians to assess for levels of parent and child anxiety and pain catastrophizing that may put them at risk for poor coping and increased child pain, and that warrant additional support. However, more research is needed to determine if greater child pain expression in healthier functioning families leads to worse or better child pain and distress. Although greater child symptom complaints are typically observed with higher pain and distress (Spagrud et al., 2008), it may be that they elicit greater adaptive parental support in healthier functioning families, leading to decreased pain. Thus, future research may choose to explore healthier family functioning as a protective factor (Ashby Wills et al., 1996), potentially moderating associations between parent-child coping, interactions, and reported experiences of pain. Future research should also consider the developmental

life cycles of families and parent-child relationships (McGoldrick et al., 2011), as well as the role of child development in pediatric pain (Palermo, Valrie, & Karlson, 2014). Age differences were noted in family functioning and child pain responding, with older children exhibiting fewer symptom complaints, higher pain tolerance, less distress following pain, as well as greater anger/frustration, and less positive affect during parent-child conflict discussions. Although this study focused on school-aged children, adolescence represents a time of natural increased independence and parent-child conflict, identifying that age group as an important target for future work (Collins & Russell, 1991). Furthermore, parent and child sex differences in family functioning in the current study suggest that gender roles of children and parents in families may be relevant to consider in future studies that are adequately powered to address these issues (McGoldrick et al., 2011).

Whereas it is possible there are few meaningful relations between general family functioning and children's pain, it is also possible that null results were found due to its lab-based methods, family functioning measurement selection (i.e., self-report or observational coding system), type of parent-child interaction task used, or the minority of families (<11%) reporting family functioning below the average range (Alderfer et al., 2008; Ginsburg et al., 2004; Skinner et al., 1995). Although wide variability of observed family functioning was seen, generalizability of findings to very poor functioning families may be limited. As compared to the local general population, the study sample is more highly educated and has a higher household income than average, but does represent greater ethnic and racial diversity (Statistics Canada, 2013), and is comparable in parent educational attainment to previous research of children with chronic pain

(Logan & Scharff, 2005; Logan et al., 2006). Furthermore, despite offering increased standardization and control over the environment, the generalizability of lab-based interactions and use of experimental pain to the real world are unclear (Birnie, Caes, et al., 2014; Kerig & Lindahl, 2001), with replication during clinical pain experiences clearly needed. Despite these limitations, the value of multi-informant multi-method assessment in the current study was highlighted by the unique findings depending on reporting source (children or parents), and with observed aspects of family functioning. Additional strengths of the study are the application of the actor-partner interdependence model to parent-child dyads and larger representation of fathers than in previous research (Gauntlett-Gilbert & Eccleston, 2007; Guite et al., 2009).

This study builds on research implicating family functioning in children's coping with pediatric pain by identifying relations between less healthy family functioning and greater parent and child dispositional vulnerability to poor pain coping. It refines our understanding of the social contextual factors that influence children's behaviours during pain, by indicating that various aspects of family functioning contribute to both greater pain and non-pain talk by children. Overall, this study represents an important step forward in our understanding of general family factors to children's pain, an area that has received relatively minimal empirical attention, and that has been largely limited by its single-source assessment of families.

3.6 REFERENCES

- Alderfer, M. A., Fiese, B. H., Gold, J. I., Cutuli, J. J., Holmbeck, G. N., Goldbeck, L., et al. (2008). Evidence-based assessment in pediatric psychology: Family measures. *Journal of Pediatric Psychology, 33*(9), 1046-1061. doi:10.1093/jpepsy/jsm083
- Ashby Wills, T., Blechman, E. A., & McNamara, G. (1996). Family support, coping, and competence. In E. M. Hetherington & E. A. Blechman (Eds.), *Stress, coping, and resiliency in children and families*. (pp. 107-134). New York, NY: Psychology Press.
- Beck, A. T. & Steer, R. A. (1993). *Beck anxiety inventory manual*. Bloomington, MN: Pearson.
- Birmaher, B., Brent, D. A., Chiappetta, L., Bridge, J., Monga, S., & Baugher, M. (1999). Psychometric properties of the screen for child anxiety related emotional disorders (SCARED): A replication study. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*(10), 1230-1236. doi:10.1097/00004583-199910000-00011
- Birnie, K. A., Caes, L., Wilson, A. C., Williams, S. E., & Chambers, C. T. (2014). A practical guide and perspectives on the use of experimental pain modalities with children and adolescents. *Pain Management, 4*(2), 97-111. doi:10.2217/pmt.13.72
- Birnie, K. A., Chambers, C. T., Chorney, J., Fernandez, C. V., & McGrath, P. J. (2015b). *Dyadic analysis of child and parent trait and state pain catastrophizing in children's pain*. Manuscript submitted for publication.
- Birnie, K. A., Noel, M., Chambers, C. T., von Baeyer, C. L., & Fernandez, C. V. (2011). The cold pressor task: Is it an ethically acceptable pain research method in children? *Journal of Pediatric Psychology, 36*(10), 1071-1081. doi:10.1093/jpepsy/jsq092
- Birnie, K. A., Parker, J. A., & Chambers, C. T. (2014). Relevance of water temperature, apparatus, and age to children's pain during the cold pressor task. *Pain Practice*. Advance online access. doi:10.1111/papr.12257
- Birnie, K. A., Petter, M., Boerner, K. E., Noel, M., & Chambers, C. T. (2012). Contemporary use of the cold pressor task in pediatric pain research: A systematic review of methods. *The Journal of Pain, 13*(9), 817-826. doi:10.1016/j.jpain.2012.06.005
- Boerner, K. E., Chambers, C. T., Craig, K. D., Pillai Riddell, R. R., & Parker, J. A. (2013). Caregiver accuracy in detecting deception in facial expressions of pain in children. *Pain, 154*(4), 525-33. doi:10.1016/j.pain.2012.12.015

- Boerner, K. E., Noel, M., Birnie, K. A., Caes, L., Petter, M., & Chambers, C. T. (2015). Impact of threat level, task instruction, and individual characteristics on cold pressor pain and fear among children and their parents. *Pain Practice*. Advance online access. doi:10.1111/papr.12306
- Bögels, S. M. & Brechman-Toussaint, M. L. (2006). Family issues in child anxiety: Attachment, family functioning, parental rearing and beliefs. *Clinical Psychology Review, 26*(7), 834-856. doi:10.1016/j.cpr.2005.08.001
- Caes, L., Goubert, L., Devos, P., Verlooy, J., Benoit, Y., & Vervoort, T. (2014). The relationship between parental catastrophizing about child pain and distress in response to medical procedures in the context of childhood cancer treatment: A longitudinal analysis. *Journal of Pediatric Psychology, 39*(7), 677-686. doi:10.1093/jpepsy/jsu034
- Caes, L., Vervoort, T., Devos, P., Verlooy, J., Benoit, Y., & Goubert, L. (2014). Parental distress and catastrophic thoughts about child pain: Implications for parental protective behavior in the context of child leukemia-related medical procedures. *The Clinical Journal of Pain, 30*(9), 787-799. doi:10.1097/ajp.0000000000000028
- Caes, L., Vervoort, T., Eccleston, C., Vandenhende, M., & Goubert, L. (2011). Parental catastrophizing about child's pain and its relationship with activity restriction: The mediating role of parental distress. *Pain, 152*(1), 212-222. doi:10.1016/j.pain.2010.10.037
- Caes, L., Vervoort, T., Trost, Z., & Goubert, L. (2012). Impact of parental catastrophizing and contextual threat on parents' emotional and behavioral responses to their child's pain. *Pain, 153*(3), 687-695. doi:10.1016/j.pain.2011.12.007
- Campbell, C. M., Kronfli, T., Buenaver, L. F., Smith, M. T., Berna, C., Haythornthwaite, J. A., et al. (2010). Situational versus dispositional measurement of catastrophizing: Associations with pain responses in multiple samples. *The Journal of Pain, 11*(5), 443-453.e2. doi:10.1016/j.jpain.2009.08.009
- Chambers, C. T., Craig, K. D., & Bennett, S. M. (2002). The impact of maternal behavior on children's pain experiences: An experimental analysis. *Journal of Pediatric Psychology, 27*(3), 293-301. doi:10.1093/jpepsy/27.3.293
- Chorney, J. M., McMurtry, C. M., Chambers, C. T., & Bakeman, R. (2015). Developing and modifying behavioral coding schemes in pediatric psychology: A practical guide. *Journal of Pediatric Psychology, 40*(1), 154-164. doi:10.1093/jpepsy/jsu099
- Cohen, L. L., Manimala, R., & Blount, R. L. (2000). Easier said than done: What parents say they do and what they do during children's immunizations. *Children's Health Care, 29*(2), 79-86. doi:10.1207/s15326888chc2902_1

- Collins, W. A. & Russell, G. (1991). Mother-child and father-child relationships in middle childhood and adolescence: A developmental analysis. *Developmental Review, 11*(2), 99-136. doi:10.1016/0273-2297(91)90004-8
- Cook, W. & Kenny, D. (2005). The actor-partner interdependence model: A model of bidirectional effects in developmental studies. *International Journal of Behavioral Development, 29*(2), 101-109. doi:10.1080/01650250444000405
- Creamer, M., Foran, J., & Bell, R. (1995). The beck anxiety inventory in a non-clinical sample. *Behaviour Research and Therapy, 33*(4), 477-485. doi:10.1016/0005-7967(94)00082-u
- Crombez, G., Bijttebier, P., Eccleston, C., Mascagni, T., Mertens, G., Goubert, L., et al. (2003). The child version of the pain catastrophizing scale (PCS-C): A preliminary validation. *Pain, 104*(3), 639-646. doi:10.1016/s0304-3959(03)00121-0
- Dahlquist, L. M., Power, T. G., & Carlson, L. (1995). Physician and parent behavior during invasive pediatric cancer procedures: Relationships to child behavioral distress. *Journal of Pediatric Psychology, 20*(4), 477-490. doi:10.1093/jpepsy/20.4.477
- DeBoard-Lucas, R. L., Fosco, G. M., Raynor, S. R., & Grych, J. H. (2010). Interparental conflict in context: Exploring relations between parenting processes and children's conflict appraisals. *Journal of Clinical Child and Adolescent Psychology, 39*(2), 163-175. doi:10.1080/15374410903532593
- DeLambo, . E., Ievers-Landis, . E., Drotar, D., & Quittner, . L. (2004). Association of observed family relationship quality and problem-solving skills with treatment adherence in older children and adolescents with cystic fibrosis. *Journal of Pediatric Psychology, 29*(5), 343-353. doi:10.1093/jpepsy/jsh038
- Donenberg, G. R. & Weisz, J. R. (1997). Experimental task and speaker effects on parent-child interactions of aggressive and depressed/anxious children. *Journal of Abnormal Child Psychology, 25*(5), 367-387.
- Driscoll, K. A., Schatschneider, C., McGinnity, K., & Modi, A. C. (2012). Application of dyadic data analysis in pediatric psychology: Cystic fibrosis health-related quality of life and anxiety in child-caregiver dyads. *Journal of Pediatric Psychology, 37*(6), 605-611. doi:10.1093/jpepsy/jss063
- Fales, J. L., Essner, B. S., Harris, M. A., & Palermo, T. M. (2014). When helping hurts: Miscarried helping in families of youth with chronic pain. *Journal of Pediatric Psychology, 39*(4), 427-437. doi:10.1093/jpepsy/jsu003

- Fisher, E., Caes, L., Clinch, J., Tobias, J. H., & Eccleston, C. (2015). Anxiety at 13 and its effect on pain, pain-related anxiety, and pain-related disability at 17: An ALSPAC cohort longitudinal analysis. *Psychology, Health & Medicine*. Advance online access. doi:10.1080/13548506.2015.1051062
- Fleiss, J. L., Levin, B., & Cho Paik, M. (2003). *Statistical methods for rates and proportions* (3rd ed.). New York, NY: John Wiley & Sons, Inc.
- Gauntlett-Gilbert, J. & Eccleston, C. (2007). Disability in adolescents with chronic pain: Patterns and predictors across different domains of functioning. *Pain, 131*(1-2), 132-141. hdoi:10.1016/j.pain.2006.12.021
- Ginsburg, G. S., Siqueland, L., Masia-Warner, C., & Hedtke, K. A. (2004). Anxiety disorders in children: Family matters. *Cognitive and Behavioral Practice, 11*(1), 28-43. doi:10.1016/s1077-7229(04)80005-1
- Goodman, J. E. & McGrath, P. J. (2003). Mothers' modeling influences children's pain during a cold pressor task. *Pain, 104*(3), 559-565. doi:10.1016/s0304-3959(03)00090-3
- Goubert, L., Craig, K. D., Vervoort, T., Morley, S., Sullivan, M. J., de C Williams, A. C., et al. (2005). Facing others in pain: The effects of empathy. *Pain, 118*(3), 285-288. doi:10.1016/j.pain.2005.10.025
- Goubert, L., Eccleston, C., Vervoort, T., Jordan, A., & Crombez, G. (2006). Parental catastrophizing about their child's pain. The parent version of the pain catastrophizing scale (PCS-P): A preliminary validation. *Pain, 123*(3), 254-263. doi:10.1016/j.pain.2006.02.035
- Goubert, L., Vervoort, T., Sullivan, M. J., Verhoeven, K., & Crombez, G. (2008). Parental emotional responses to their child's pain: The role of dispositional empathy and catastrophizing about their child's pain. *The Journal of Pain, 9*(3), 272-279. doi:10.1016/j.jpain.2007.11.006
- Goubert, L., Vlaeyen, J. W., Crombez, G., & Craig, K. D. (2011). Learning about pain from others: An observational learning account. *The Journal of Pain, 12*(2), 167-174. doi:10.1016/j.jpain.2010.10.001
- Guite, J. W., Logan, D. E., McCue, R., Sherry, D. D., & Rose, J. B. (2009). Parental beliefs and worries regarding adolescent chronic pain. *The Clinical Journal of Pain, 25*(3), 223-232. doi:10.1097/ajp.0b013e31818a7467
- Hadjistavropoulos, T., Craig, K. D., Duck, S., Cano, A., Goubert, L., Jackson, P. L., et al. (2011). A biopsychosocial formulation of pain communication. *Psychological Bulletin, 137*(6), 910-939. doi:10.1037/a0023876

- Hale, W. W., Raaijmakers, Q., Muris, P., & Meeus, W. I. M. (2005). Psychometric properties of the screen for child anxiety related emotional disorders (SCARED) in the general adolescent population. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*(3), 283-290. doi:10.1097/00004583-200503000-00013
- Hicks, C. L., von Baeyer, C. L., Spafford, P. A., van Korlaar, I., & Goodenough, B. (2001). The faces pain scale-revised: Toward a common metric in pediatric pain measurement. *Pain, 93*(2), 173-183. doi:10.1016/s0304-3959(01)00314-1
- Holmbeck, G. N., Li, S. T., Schurman, J. V., Friedman, D., & Coakley, R. M. (2002). Collecting and managing multisource and multimethod data in studies of pediatric populations. *Journal of Pediatric Psychology, 27*(1), 5-18. doi:10.1093/jpepsy/27.1.5
- Jastrowski Mano, K. E., Khan, K. A., Ladwig, R. J., & Weisman, S. J. (2011). The impact of pediatric chronic pain on parents' health-related quality of life and family functioning: Reliability and validity of the pedsql 4.0 family impact module. *Journal of Pediatric Psychology, 36*(5), 517-527. doi:10.1093/jpepsy/jsp099
- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: The Guilford Press.
- Kerig, P.K. & Lindahl, K.M. (Eds.). (2001) *Family Observational Coding Systems: Resources for Systemic Research*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Kitzmann, K. M. (2000). Effects of marital conflict on subsequent triadic family interactions and parenting. *Developmental Psychology, 36*(1), 3-13. doi:10.1037//0012-1649.36.1.3
- Kliewer, W., Fearnow, M. D., & Miller, P. A. (1996). Coping socialization in middle childhood: Tests of maternal and paternal influences. *Child Development, 67*(5), 2339-2357. doi:10.2307/1131627
- Kliewer, W., Sandler, I., & Wolchik, S. (1994). Family socialization of threat appraisal and coping: Coaching, modeling, and family context. *Social Networks and Social Support in Childhood and Adolescence, 16*, 279-291. doi:10.1515/9783110866377.271
- Lewandowski, A. S. & Palermo, T. M. (2009). Parent-teen interactions as predictors of depressive symptoms in adolescents with headache. *Journal of Clinical Psychology in Medical Settings, 16*(4), 331-338. doi:10.1007/s10880-009-9173-8
- Lewandowski, A. S., Palermo, T. M., Stinson, J., Handley, S., & Chambers, C. T. (2010). Systematic review of family functioning in families of children and adolescents with chronic pain. *The Journal of Pain, 11*(11), 1027-1038. doi:10.1016/j.jpain.2010.04.005

- Lindahl, K. M. (1998). Family process variables and children's disruptive behavior problems. *Journal of Family Psychology, 12*(3), 420-436. doi:10.1037/0893-3200.12.3.420
- Lindahl, K. M. & Malik, N. M. (1999). Marital conflict, family processes, and boys' externalizing behavior in hispanic american and european american families. *Journal of Clinical Child Psychology, 28*(1), 12-24. doi:10.1207/s15374424jccp2801_2
- Lindahl, K. M. & Malik, N. M. (2000). *System for coding interactions and family functioning (SCIFF): A coding system for family problem discussions*. Coral Gables, FL: University of Miami.
- Lindahl, K. M. & Malik, N. M. (2001). The system for coding interactions and family functioning. In P. K. Kerig & K. M. Lindahl (Eds.), *Family observational coding systems: Resources for systematic research*. (pp. 77-91). Mahwah, NJ: Lawrence Erlbaum Associates.
- Link, C. J. & Fortier, M. A. (2015). The relationship between parent trait anxiety and parent-reported pain, solicitous behaviors, and quality of life impairment in children with cancer. *Journal of Pediatric Hematology/Oncology*. Advance online access. doi:10.1097/mpg.0000000000000376
- Logan, D. E., Guite, J. W., Sherry, D. D., & Rose, J. B. (2006). Adolescent-parent relationships in the context of adolescent chronic pain conditions. *The Clinical Journal of Pain, 22*(6), 576-583. doi:10.1097/01.ajp.0000210900.83096.ca
- Logan, D. E. & Scharff, L. (2005). Relationships between family and parent characteristics and functional abilities in children with recurrent pain syndromes: An investigation of moderating effects on the pathway from pain to disability. *Journal of Pediatric Psychology, 30*(8), 698-707. doi:10.1093/jpepsy/jsj060
- Lyons, R. F., Mickelson, K. D., Sullivan, J. L., & Coyne, J. C. (1998). Coping as communal process. *Journal of Social and Personal Relationships, 15*(5), 579-605. doi:10.1177/0265407598155001
- McGoldrick, M., Carter, B. A., & Garcia Preto, N.A. (Eds.) (2011). *The Expanded Family Life Cycle: Individual, Family, and Social Perspectives* (4th ed.). Needham Heights, MA: Allyn & Bacon.
- Mitchell, S. K. (1979). Interobserver agreement, reliability, and generalizability of data collected in observational studies. *Psychological Bulletin, 86*(2), 376-390.
- Monga, S., Birmaher, B., Chiappetta, L., Brent, D., Kaufman, J., Bridge, J., et al. (2000). Screen for child anxiety-related emotional disorders (SCARED): Convergent and divergent validity. *Depression and Anxiety, 12*(2), 85-91. doi:10.1002/1520-6394(2000)12:2<85::aid-da4>3.0.co;2-2

- Moon, E. C., Chambers, C. T., & McGrath, P. J. (2011). "He says, she says": A comparison of fathers' and mothers' verbal behavior during child cold pressor pain. *The Journal of Pain, 12*(11), 1174-1181. doi:10.1016/j.jpain.2011.06.004
- Pagé, M. G., Campbell, F., Isaac, L., Stinson, J., Martin-Pichora, A. L., & Katz, J. (2011). Reliability and validity of the child pain anxiety symptoms scale (CPASS) in a clinical sample of children and adolescents with acute postsurgical pain. *Pain, 152*(9), 1958-1965. doi:10.1016/j.pain.2011.02.053
- Pagé, M. G., Katz, J., Stinson, J., Isaac, L., Martin-Pichora, A. L., & Campbell, F. (2012). Validation of the numerical rating scale for pain intensity and unpleasantness in pediatric acute postoperative pain: Sensitivity to change over time. *The Journal of Pain, 13*(4), 359-369. doi:10.1016/j.jpain.2011.12.010
- Palermo, T. M. & Chambers, C. T. (2005). Parent and family factors in pediatric chronic pain and disability: An integrative approach. *Pain, 119*(1-3), 1-4. doi:10.1016/j.pain.2005.10.027
- Palermo, T. M., Valrie, C. R., & Karlson, C. W. (2014). Family and parent influences on pediatric chronic pain: A developmental perspective. *The American Psychologist, 69*(2), 142-152. doi:10.1037/a0035216
- Parkerson, H. A., Noel, M., Pagé, M. G., Fuss, S., Katz, J., & Asmundson, G. J. (2013). Factorial validity of the english-language version of the pain catastrophizing scale--child version. *The Journal of Pain, 14*(11), 1383-1389. doi:10.1016/j.jpain.2013.06.004
- Pielech, M., Ryan, M., Logan, D., Kaczynski, K., White, M. T., & Simons, L. E. (2014). Pain catastrophizing in children with chronic pain and their parents: Proposed clinical reference points and reexamination of the pain catastrophizing scale measure. *Pain, 155*(11), 2360-2367. doi:10.1016/j.pain.2014.08.035
- Power, T. G. (2004). Stress and coping in childhood: The parents' role. *Parenting: Science and Practice, 4*(4), 271-317. doi:10.1207/s15327922par0404_1
- Robin, A. L. & Foster, S. L. (1989). *Negotiating parent-adolescent conflict: A behavioral-family systems approach*. New York, NY: Guilford Press.
- Ross, C. K., Lavigne, J. V., Hayford, J. R., Berry, S. L., Sinacore, J. M., & Pachman, L. M. (1993). Psychological factors affecting reported pain in juvenile rheumatoid arthritis. *Journal of Pediatric Psychology, 18*(5), 561-73.
- Schanberg, L. E., Keefe, F. J., Lefebvre, J. C., Kredich, D. W., & Gil, K. M. (1998). Social context of pain in children with juvenile primary fibromyalgia syndrome: Parental pain history and family environment. *The Clinical Journal of Pain, 14*(2), 107-115. doi:10.1097/00002508-199806000-00004

- Shrout, P. E. & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin*, *86*(2), 420-428. doi:10.1037/0033-2909.86.2.420
- Skinner, H., Steinhauer, P., & Santa-Barbara, J. (1995). *Brief FAM: General scale*. Toronto, ON: Multi-Health Systems, Inc.
- Skinner, H., Steinhauer, P., & Sitarenios, G. (2000). Family assessment measure (FAM) and process model of family functioning. *Journal of Family Therapy*, *22*(2), 190-210. doi:10.1111/1467-6427.00146
- Spagrud, L. J., von Baeyer, C. L., Ali, K., Mpofu, C., Fennell, L. P., Friesen, K., et al. (2008). Pain, distress, and adult-child interaction during venipuncture in pediatric oncology: An examination of three types of venous access. *Journal of Pain and Symptom Management*, *36*(2), 173-184. doi:10.1016/j.jpainsymman.2007.10.009
- Statistics Canada. (2013). *Nova Scotia (code 12) (table). National household survey (NHS profile). 2011 national household survey. Statistics Canada catalogue no. 99-004-XWE*. Ottawa. Retrived from <http://www12.statcan.gc.ca>
- Stinson, J. N., Kavanagh, T., Yamada, J., Gill, N., & Stevens, B. (2006). Systematic review of the psychometric properties, interpretability and feasibility of self-report pain intensity measures for use in clinical trials in children and adolescents. *Pain*, *125*(1-2), 143-157. doi:10.1503/cmaj.101341
- Sturgeon, J. A. & Zautra, A. J. (2013a). Psychological resilience, pain catastrophizing, and positive emotions: Perspectives on comprehensive modeling of individual pain adaptation. *Current Pain and Headache Reports*, *17*(3), 317-326. doi:10.1007/s11916-012-0317-4
- Sullivan, M. J. (2012). The communal coping model of pain catastrophizing: Clinical and research implications. *Canadian Psychology*, *53*(1), 32-41. doi:10.1037/a0026726
- Tabachnick, B. G. & Fidell, L. (2001). *Using multivariate statistics* (5th ed.). Toronto, ON: Pearson.
- Taylor, C., Sellick, K., & Greenwood, K. (2011). The influence of adult behaviors on child coping during venipuncture: A sequential analysis. *Research in Nursing & Health*, *34*(2), 116-131. doi:10.1002/nur.20424
- Tremblay, I. & Sullivan, M. J. (2010). Attachment and pain outcomes in adolescents: The mediating role of pain catastrophizing and anxiety. *The Journal of Pain*, *11*(2), 160-171. doi:10.1016/j.jpain.2009.06.015
- Vervoort, T., Eccleston, C., Goubert, L., Buysse, A., & Crombez, G. (2010). Children's catastrophic thinking about their pain predicts pain and disability 6 months later. *European Journal of Pain (London, England)*, *14*(1), 90-96. <http://dx.doi.org/10.1016/j.ejpain.2009.03.001>

- Vervoort, T., Goubert, L., Eccleston, C., Vandenhende, M., Claeys, O., Clarke, J., et al. (2009). Expressive dimensions of pain catastrophizing: An observational study in adolescents with chronic pain. *Pain, 146*(1-2), 170-176. doi:10.1016/j.pain.2009.07.021
- Vervoort, T., Goubert, L., Vandebossche, H., Van Aken, S., Matthys, D., & Crombez, G. (2011). Child's and parents' catastrophizing about pain is associated with procedural fear in children: A study in children with diabetes and their mothers. *Psychological Reports, 109*(3), 879-895. doi:10.2466/07.15.16.21.pr0.109.6.879-895
- von Baeyer, C. L., Piira, T., Chambers, C. T., Trapanotto, M., & Zeltzer, L. K. (2005). Guidelines for the cold pressor task as an experimental pain stimulus for use with children. *The Journal of Pain, 6*(4), 218-227. doi:10.1016/j.jpain.2005.01.349
- Walker, L. S., Williams, S. E., Smith, C. A., Garber, J., Van Slyke, D. A., & Lipani, T. A. (2006). Parent attention versus distraction: Impact on symptom complaints by children with and without chronic functional abdominal pain. *Pain, 122*(1-2), 43-52. doi:10.1016/j.pain.2005.12.020
- Williams, S. E., Blount, R. L., & Walker, L. S. (2011). Children's pain threat appraisal and catastrophizing moderate the impact of parent verbal behavior on children's symptom complaints. *Journal of Pediatric Psychology, 36*(1), 55-63. doi:10.1093/jpepsy/jsq043
- Yoder, P. J. & Symons, F. J. (2010). *Observational measurement of behavior*. New York, NY: Springer Publishing Company.
- Zimmer-Gembeck, M. J. & Locke, E. M. (2007). The socialization of adolescent coping behaviours: Relationships with families and teachers. *Journal of Adolescence, 30*(1), 1-16. doi:10.1016/j.adolescence.2005.03.001

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Table 3.1

Means, standard deviations, and range for study variables.

	Mean	SD	Range
Reported Family Functioning (Brief FAM)^a			
Child-report	13.04	5.06	1-30
Parent-report	9.58	4.85	0-23
Observed Family Functioning (SCIFF)			
Family: Negativity and conflict	2.02	1.11	1-5
Family: Positive affect	1.91	1.01	1-5
Family: Cohesiveness	3.32	1.10	1-5
Family: Focus of problem ^b	1.87	1.32	1-5
Parent: Rejection & invalidation	2.50	1.36	1-5
Parent: Emotional support	3.10	1.17	1-5
Child: Anger and frustration	1.89	1.05	1-5
Child: Withdrawal	2.20	1.21	1-5
Child: Opposition & defiance	2.31	1.48	1-5
Child: Positive affect	2.27	1.15	1-5
Trait Anxiety			
Child (SCARED)	21.64	10.16	3-49
Parent (BAI)	4.66	5.07	0-26
Trait Pain Catastrophizing			
Child (PCS-C)	20.79	10.85	0-48
Parent (PCS-P)	17.81	9.12	3-51
Situational Self-Oriented Distress			
Child (CDQ)	1.18	1.42	0-10
Parent (PDSQ)	0.68	1.44	0-8.25
State Pain Catastrophizing			
Child (PCS-C state)	15.89	11.79	0-49
Parent (PCS-P state)	14.24	10.54	0-50
Child Pain Intensity (FPS-R)			
Child-report	4.60	2.93	0-10
Parent-report	4.39	2.76	0-10
Child Pain Unpleasantness (VAS)			
Child-report	4.56	3.10	0-10
Parent-report	4.71	2.61	0-10
Child Pain Tolerance (seconds)	132.10	102.72	7-240

^aHigher scores on reported family functioning measure indicate poorer family functioning. ^bHigher scores indicate greater shared family responsibility for family problems and lower scores indicate greater child-centered responsibility for family problems.

Table 3.2

Correlations between self-reported and observed family functioning.

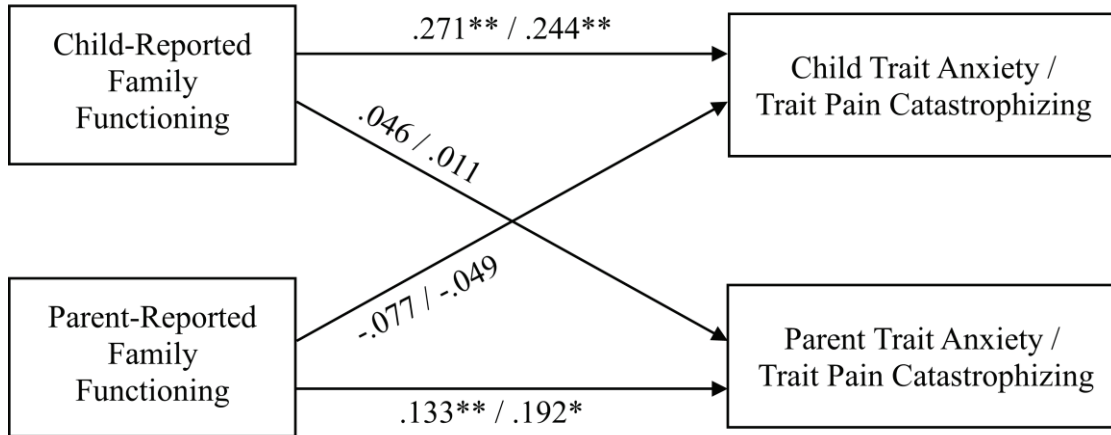
	Self-reported Family Functioning (Brief FAM) ^a	
	Child Report	Parent Report
Observed Family Functioning (SCIFF)		
Family: Negativity and conflict	.150	.265**
Family: Positive affect	-.099	-.116
Family: Cohesiveness	-.184*	-.190*
Family: Focus of problem ^b	.019	-.006
Parent: Rejection and invalidation	.179*	.151*
Parent: Emotional support	-.091	-.129
Child: Anger and frustration	.153*	.083
Child: Withdrawal	.192*	.078
Child: Opposition and defiance	.212**	.083
Child: Positive affect	-.167*	-.051

^aHigher scores on reported family functioning indicate poorer family functioning.

^bHigher scores indicate greater shared family responsibility for family problems and lower scores indicate greater child-centered responsibility for family problems. ** $p < .01$; * $p < .05$

Figure 3.1

Actor-partner interdependence model of reported family functioning predicting trait anxiety and trait pain catastrophizing.



Note. Reports standardized regression coefficients for trait anxiety to the left of the slash and trait pain catastrophizing to the right of the slash. $^{**}p < .01$; $^{*}p < .05$

CHAPTER 4: DISCUSSION

4.1 SUMMARY OF KEY FINDINGS

This dissertation used a rigorous methodological and dyadic statistical approach to examine associations between child and parent pain catastrophizing and family functioning in children's pain. Individual (child and parent), dyadic (parent-child interactions), and family-level factors were conceptualized as relevant to children's pain experience (Palermo & Chambers, 2005; Palermo, Valrie & Karlson, 2014) and were assessed using multi-informant multi-method approaches. Specifically, parent-child dyads completed two brief lab-based interactions, including the child's completion of the cold pressor task (CPT) with the parent present, and a parent-child conflict discussion task. Children and parents provided self-report on individual dispositional vulnerability factors to poor pain coping (their own trait anxiety and trait tendency to catastrophize about the child's pain), situational pain coping (self-oriented distress and state tendency to catastrophize about the child's pain during the CPT), and ratings of child pain intensity and unpleasantness following the CPT. Child pain tolerance during the CPT was also recorded. Family functioning was assessed using self-report provided by children and parents, as well as macro-observational coding of parent-child interactions during the conflict discussion task. Pain-specific child and parent verbal behaviours were also captured using micro-observational coding during the CPT.

Objectives addressed in the first paper were the investigation of intra- and inter-personal contributions of child and parent trait or state pain catastrophizing in predicting parent-child interactions during child pain and child pain outcomes. Parent pain attending and non-attending talk during child pain were predicted by child age and observed child

behaviours; however, in contrast to hypotheses, they were not predicted by child or parent pain catastrophizing (trait or state), or their interaction. Child symptom complaints during child pain were predicted by child age and observed parent behaviours, as well as uniquely by child and parent state pain catastrophizing, and their interaction. More specifically, level of state pain catastrophizing by parents moderated the relation between higher child state pain catastrophizing and greater child symptom complaints. Children reporting high levels of state pain catastrophizing had similarly higher amounts of symptom complaints regardless of the level of parent state pain catastrophizing; whereas children reporting low levels of state pain catastrophizing engaged in significantly higher amounts of symptom complaints, at levels comparable to children with high state pain catastrophizing, but only when they had a parent with high levels of state pain catastrophizing. Children from dyads with both reporting low levels of state pain catastrophizing engaged in fewer symptom complaints. Child symptom complaints were not predicted by child or parent trait pain catastrophizing. With regards to child pain outcomes, greater state pain catastrophizing by children and parents predicted their own higher ratings of child pain intensity and unpleasantness, as expected, with higher state pain catastrophizing by children additionally contributing to higher parent ratings of child pain intensity and unpleasantness. Greater trait pain catastrophizing by children and parents predicted their own higher ratings of child pain unpleasantness, but only child trait pain catastrophizing predicted more intense self-reported pain. Higher pain tolerance was seen amongst children who were older and reported lower levels of state pain catastrophizing.

Objectives addressed in the second paper were the examination of the role of reported and observed family functioning in aspects of child pain, including child pain outcomes (parent and child ratings of intensity and unpleasantness, and pain tolerance), parent-child interactions during child pain, child and parent dispositional vulnerability factors to poor pain coping (trait anxiety and pain catastrophizing), and situational coping (self-oriented distress and state pain catastrophizing). In contrast to hypotheses, no relations were found between family functioning and child pain outcomes. Aspects of observed family functioning predicted child symptoms complaints and other talk during the CPT. Specifically, children engaged in greater symptom complaints when less negativity/conflict, less cohesiveness, more parent emotional support, and more shared family responsibility for family problems, was seen during the conflict discussion task. Children engaged in more other talk when more family cohesiveness, less parent emotional support, and more child-centered responsibility for family problems, was seen during the conflict discussion task. Overall, these findings reflect greater symptom complaints in children from generally healthier functioning families, which was in opposition to expected relations. Observed parent behaviours during child pain were not predicted by self-reported or observed family functioning. As hypothesized, poorer self-reported family functioning by children and parents predicted their own higher levels of trait anxiety and trait pain catastrophizing, and poorer self-reported family functioning by parents predicted greater parent distress following the CPT. Observed family functioning did not predict trait anxiety, trait pain catastrophizing, situational distress, or state pain catastrophizing.

Taken together, the results across both papers suggest that social factors external to the child (i.e., parent and family factors) exerted their greatest impact on children's verbal pain behaviours, with no direct contribution to children's reported experience of pain. Rather, intra-individual child factors (i.e., trait and state pain catastrophizing) were directly implicated in children's pain experience as evidenced through their associations with self-reported pain intensity and unpleasantness, and observed pain tolerance. On the other hand, parent ratings of child pain were predicted by both individual parent factors (i.e., trait and state pain catastrophizing), as well as by the social environment (i.e., individual child and family-level factors). Parent coping (trait anxiety, trait pain catastrophizing, and situational distress) was predicted by family-level factors.

4.2 INTEGRATION OF FINDINGS WITH EXISTING RESEARCH

4.2.1 Child and Parent Pain Catastrophizing

An emerging body of research has examined the impact of child and parent pain catastrophizing together on children's pain (Cunningham et al., 2014; Esteve, Marquina-Aponte & Ramírez-Maestre, 2014; Lynch-Jordan, Kashikar-Zuck, Szabova & Goldschneider, 2013; Pielech et al., 2014; Vowles, Cohen, McCracken & Eccleston, 2010; Welkom, Hwang & Guite, 2013; Williams, Logan, Sieberg & Simons, 2012). Studies report conflicting findings as to whether the influence of parent pain catastrophizing on child pain and coping outcomes is direct (Esteve et al., 2014; Noel, Rabbitts, Tai & Palermo, 2015; Vervoort, Trost & Van Ryckeghem, 2013) or indirect via the child's own pain catastrophizing (Cunningham et al., 2014; Vowles et al., 2010; Wilson, Moss, Palermo & Fales, 2014). Existing literature is limited by its lack of dyadic data analytic techniques, and leaves gaps in our understanding of the interplay of child

and parent pain catastrophizing to important aspects of child pain, including observed parent and child behaviours during child pain, and parent and child perceptions of child pain. Furthermore, these studies focus on trait pain catastrophizing, largely ignoring the potentially more salient influence of state pain catastrophizing on acute and experimental pain, and acute fluctuations in chronic pain (Campbell et al., 2010; Sturgeon & Zautra, 2013b).

A novel finding in the current study was the interaction of child and parent state pain catastrophizing in predicting child symptom complaints. Specifically, similar proportions of symptom complaints were seen in dyads of children with high levels of state pain catastrophizing, regardless of level of parent state pain catastrophizing. Similar proportions of symptom complaints were also seen in dyads including parents with high levels of state pain catastrophizing, regardless of child state pain catastrophizing. Thus, it appears that having at least one member of the dyad who reports high levels of state pain catastrophizing contributes to greater symptom complaints; no additive effect on symptom complaints appears when both children and parents report high state pain catastrophizing. Children from dyads where both parents and children reported low levels of state pain catastrophizing displayed fewer symptom complaints.

Existing theory and research offer several possible explanations for these newly reported findings. Based on observation and child- and parent-report, children with higher levels of pain catastrophizing tend to engage in greater verbal and nonverbal expressions of pain (Vervoort et al., 2008; Vervoort, Caes, Trost, et al., 2011; Vervoort, Goubert, Eccleston et al., 2009). The role of pain catastrophizing in pain behaviours is commonly discussed in the context of the communal coping model of pain (Sullivan,

2012), which suggests that children with high levels of pain catastrophizing engage in greater pain behaviours in order to draw sufficient attention and desired support, particularly with parents who report low levels of pain catastrophizing. This explanation is consistent with the higher levels of symptom complaints observed in children with high state pain catastrophizing with a parent reporting low state pain catastrophizing. However, prior work has found that children who are higher in pain catastrophizing engage indiscriminately in greater facial pain expression in the presence of parents or strangers irrespective of level of pain intensity (Vervoort, Caes, Trost, et al., 2011). Thus, the greater symptom complaints by children with high pain catastrophizing, irrespective of parent pain catastrophizing, may not reflect any communicative function, but could also reflect poor self-regulatory coping processes reinforced by repeated failures to cope with pain. However, when integrating this prior research with findings from the current study, it is important to note that facial expressions of pain reflect more automated processes whereas verbal expressions of pain, such as symptom complaints, are more dependent on higher mental processes (Hadjistavropoulos & Craig, 2002). Although previous work suggests that additional processes may be likely to increase the verbal pain expression of children from dyads with parents who also report high levels of state pain catastrophizing (e.g., observational learning, social modeling, fear avoidance; Goubert, Vlaeyen, Crombez & Craig, 2011; Goodman & McGrath, 2003; Goubert & Simons, 2014), it is interesting to note that this did not lead to greater symptom complaints as compared to when the child alone had high levels of state pain catastrophizing.

The greater symptom complaints observed in children with low state pain catastrophizing when a parent had high state pain catastrophizing, as compared to when

a parent had low state pain catastrophizing, have not been previously reported. According to the interpersonal fear avoidance model of pain, the presence of high parent pain catastrophizing may place children with low pain catastrophizing at greater risk for the development of chronic pain, as higher parent pain catastrophizing leads to maladaptive parent and child cognitions and behaviours, ultimately promoting poor child functioning (Goubert & Simons, 2014).

One possible explanation for these findings is that they reflect observational learning and social modeling of pain (Goubert, Vlaeyen, Crombez & Craig, 2011; Goodman & McGrath, 2003; Osborne, Hatcher, & Richtsmeier, 1989). These children may engage in increased pain expression as they have learned to do so from their high pain catastrophizing parents, who also display greater expression in response to their own pain experiences. Future research should explicitly assess the role of social modeling in these processes. Previous research indicates that parents with high levels of pain catastrophizing tend to engage in more solicitous responses to child pain, likely reinforcing greater expressions of pain in these children (Esteve et al., 2014). Although children with low pain catastrophizing may be less dependent on care from others to cope with pain (Vervoort et al., 2008), previous research has found that children with low levels of pain catastrophizing engage in greater facial pain expression when parents versus strangers are present, likely because a solicitous response is more likely (Vervoort, Caes, Trost, et al., 2011). The current study adds to those findings by suggesting that the influence of parental presence on greater verbal expressions of pain by children with low pain catastrophizing may occur more strongly with parents who have high levels of pain catastrophizing. A previous study has also reported that parents with higher trait pain

catastrophizing increasingly attend away from low facial pain expressions in children as compared with parents with low trait pain catastrophizing (Vervoort, Caes, Crombez, et al., 2011). Given that children with low pain catastrophizing display lower facial pain expressions, it is also possible that these children are engaging in greater symptom complaints in an effort to maintain parental attention and elicit support.

Given the positive relation between parent state pain catastrophizing and parent pain attending talk, and given the strong interdependence of observed parent and child behaviours, it is also possible that greater pain attending talk by parents with high state pain catastrophizing contributed to greater symptom complaints by children with low state pain catastrophizing. However, this explanation is not clearly supported for several reasons. In this study child and parent state pain catastrophizing made no significant contributions to explaining parent pain attending talk above and beyond child symptom complaints. Furthermore, a previous study observed that parents with high pain catastrophizing engaged in less pain attending talk, as compared to parents with low pain catastrophizing when neutral (versus high threat) information was provided about the experimental heat pain task completed by their child (Caes, Vervoort, Trost, et al., 2012). Instructions about the CPT in the current study were similar to the low threat information provided in that study. However, it is unclear whether pain-related threat impacted the current study's findings as a recent study using the CPT with children reported no impact of the threat value of information provided about the CPT on parent state pain catastrophizing (Boerner et al., 2015).

More research is clearly needed to determine which of these explanations are more likely. It is probable there are different, and potentially several concurrent,

mechanisms through which symptom complaints are increased depending on level of child and/or parent state pain catastrophizing. Future research should also explore whether this same pattern of results would be found in parent-child interactions using similar experimental pain methodology across both children with and without chronic pain. Previous work reports that children with chronic pain engage in fewer verbal expressions of pain to their parents despite having higher levels of pain catastrophizing as compared to children without chronic pain (Vervoort et al., 2008).

Findings from several studies in pediatric chronic pain report an indirect role of parent pain catastrophizing in children's pain and coping via child pain catastrophizing (Cunningham et al., 2014; Pielech et al., 2014; Vowles et al., 2010; Wilson, Moss, Palermo & Fales, 2014); however, these studies neglect to assess children's pain behaviours and, in doing so, have missed a direct influence of parent pain catastrophizing on children's verbal expressions of pain as demonstrated in the current study. Previous studies of children with chronic pain and their parents have reported poorer pain and coping-related outcomes in dyads where both report high trait pain catastrophizing (Williams, Logan, et al., 2012) or where adolescents report high trait pain catastrophizing and parents report low pain trait catastrophizing (Lynch-Jordan et al., 2013). These studies reported the best pain and coping-related outcomes in dyads where both children and parents had low levels of trait pain catastrophizing (Williams, Logan, et al., 2012) or dyads where children had low trait pain catastrophizing and parents had high trait pain catastrophizing (Lynch-Jordan et al., 2013). The former study is consistent with findings in the current study identifying parent-child dyads with low pain catastrophizing as a lower risk group for poor pain coping (Williams, Logan, et al., 2012). In the latter study,

greater trait pain catastrophizing by parents contributed to higher parent reports of verbal and nonverbal child pain behaviours (Lynch-Jordan et al., 2013), consistent with the unique contribution of parent pain catastrophizing to observed child symptom complaints in the current study. Although, no group differences were noted in parent-reported child pain behaviours based on pain catastrophizing parent-child dyad in that prior study. Differences in study methodology are likely relevant in explaining discrepant findings between these two previous studies, as one study combined dyads where both children and parents reported the same level of trait pain catastrophizing (high or low) into a single group (Lynch-Jordan et al., 2013). Furthermore, both of those studies employed median splits to categorize high versus low levels of child and parent pain catastrophizing, as opposed to the consideration of pain catastrophizing in the current study as a continuous variable. It has been suggested that shared pain catastrophizing tendencies by both children and parents enhances the negative effects of pain catastrophizing, and that having at least one member of the dyad who has low pain catastrophizing (parent or child) may buffer its negative effects on child pain and coping (Goubert & Simons, 2014; Williams, Logan, et al., 2012). These hypotheses were not supported in the current study as no additive negative effect of parent and child trait or state pain catastrophizing was seen. Rather, having one member of the dyad with high levels of state pain catastrophizing predicted increased expressions of child pain.

Previous studies have reported contributions of child and parent pain catastrophizing in predicting parent responses to child chronic, experimental, and clinical acute pain (Caes, Vervoort, et al., 2014; Caes, Vervoort, Trost, et al., 2012; Hechler et al., 2011; Langer, Romano, Mancl & Levy, 2014). The lack of observed relations in the

current study could be explained by differences in data analysis. Given the strong interdependence of parent-child interactions (Taylor, Sellick & Greenwood, 2011), the current study chose to explore any impact of child and/or parent pain catastrophizing to parent behaviours above and beyond the contribution of child behaviours. In this study, child behaviours and child age accounted for a moderate amount of variance in parent pain attending (~19.0% of variance) and non-attending talk (~30% of variance). Thus, it is likely that significant findings relating child and parent pain catastrophizing and parent behaviours that have been observed in previous studies were not found here due to the explanatory value of child behaviours in predicting parent behaviours in the current study (Caes, Vervoort, Trost, et al., 2012; Hechler et al., 2011; Langer et al., 2014). A previous study of parent behaviours prior to and following a lumbar puncture for children with cancer took a similar approach to data analysis as the current study (Caes, Vervoort, et al., 2014). That study did report a significant contribution of parent state pain catastrophizing to nonverbal pain attending behaviours of parents prior to a lumbar puncture, above and beyond child verbal and nonverbal pain behaviours; however, similar to the current study, no unique influence of parent state pain catastrophizing was seen on parent verbal pain attending behaviours (Caes, Vervoort, et al., 2014). In that prior study, child age, time since diagnosis, and child verbal and nonverbal pain behaviours accounted for 17-68% of variance in parent verbal and nonverbal attending behaviours, with parent state pain catastrophizing adding 0-4% of unique variance depending on the model. It did not include measures of child pain catastrophizing.

Associations between child pain catastrophizing and child self-reported pain outcomes, and parent pain catastrophizing and parent ratings of child pain outcomes,

have been repeatedly demonstrated (Boerner et al., 2015; Esteve et al., 2014; Goubert, Vervoort, Cano & Crombez, 2009; Vervoort, Caes, Trost, et al., 2011; Vervoort, Goubert, Eccleston, et al., 2009; Vervoort, Goubert, et al., 2011); however very few studies have explored interpersonal influences of child or parent pain catastrophizing on the others' report of child pain. Similar to the current study, a recent investigation found no association between parent pain catastrophizing and child self-reported pain intensity during the CPT (Boerner et al., 2015). However, in the current study, an interpersonal influence of child state pain catastrophizing on parent ratings of child pain was observed, beyond parents' own tendency to catastrophize about the child's pain. Very likely this occurs via greater pain expression by children with higher levels of pain catastrophizing (Vervoort, Caes, Trost, et al., 2011); however, as has been previously mentioned, parents appear differentially sensitive to children's expressions of pain based on their own level of pain catastrophizing (Vervoort, Caes, Crombez, et al., 2011). Previous research has also found higher state pain catastrophizing by parents or lower state pain catastrophizing by children to contribute to greater similarity between child and parent ratings of child pain (Goubert et al., 2009; Vervoort, Goubert & Crombez, 2009); however child and parent pain catastrophizing were not concurrently considered in those studies. Future research should explore whether greater congruency between child and parent ratings with higher parent pain catastrophizing is found at all levels of child pain catastrophizing. Given the lack of contribution of parent pain catastrophizing to children's pain outcomes, it seems that level of child pain catastrophizing contributes most critically to children's pain intensity, unpleasantness, and tolerance, regardless of level of parent pain catastrophizing and differences in level of symptom complaints.

Future research should investigate more nuanced relations with trait versus state pain catastrophizing, as stronger relations were generally observed in the current study with state pain catastrophizing, and parent-child interactions and child pain. Similar to recent work (Boerner et al., 2015), increased trait pain catastrophizing was associated with increased state pain catastrophizing. This is consistent with the conceptualization of trait pain catastrophizing as a vulnerability trait and state pain catastrophizing as a vulnerability mechanism more proximally related to pain coping responses (Sturgeon & Zautra, 2013a). Despite state pain catastrophizing being more strongly implicated in acute and experimental pain, not all studies have reported significant associations between trait and state measures (Campbell et al., 2010). Very few studies in pediatric pain have concurrently assessed trait and state pain catastrophizing (Boerner et al., 2015), although findings indicate that trait pain catastrophizing moderates associations between state pain catastrophizing and daily fluctuations in pain intensity in adults with chronic pain (Sturgeon & Zautra, 2013b). Understanding more formally the relations between trait and state aspects of pain catastrophizing can inform what are the most effective targets for treatment for different types of pain experience.

No associations were found in the current study between total scores of child and parent trait or state pain catastrophizing or between any of the trait subscale scores. However, given that other studies examining parent and child trait pain catastrophizing have found associations between specific dimensions of pain catastrophizing only (Noel et al., 2015; Vervoort et al., 2013), future research should include planned analyses at the subscale level. Magnification, rumination, and helplessness dimensions of pain catastrophizing may reflect different aspects of coping appraisal (Severeijns, Vlaeyen &

van den Hout, 2004) and have shown unique roles in children's pain-related attention and avoidance behaviour (Vervoort et al., 2013) and memories of post-operative pain (Noel et al., 2015). The absence of associations between child and parent pain catastrophizing was consistent with a general trend in the current study to observe significant correlations between variables reported by either the parent or child, but not across child and parent-reported variables. The tendency to observe associations between variables reported by the same individual, but not between variables reported by different individuals has been noted in other multi-informant work (Holmbeck, Li, Schurman, Friedman & Coakley, 2002).

4.2.2 Family Functioning in Pediatric Pain

To our knowledge this is the first study to use a multi-informant multi-method approach to examine general family functioning in children's pain. Although family functioning was not related to all aspects of children's experimental pain in the current study, it was associated with child and parent dispositional vulnerability to poor pain coping, children's symptom complaints during pain, and parent self-oriented distress in response to child pain. Specifically, child and parent reports of poorer family functioning were associated with their own increased trait anxiety and trait catastrophizing about the child's pain. This is consistent with understanding the family as the most immediate and powerful context in which children learn and develop coping strategies that they employ across contexts (Kliewer, Sandler & Wolchik, 1994; Power, 2004; Zimmer-Gembeck & Locke, 2007). Poorer family functioning has previously been observed amongst children or parents with anxiety disorders (Bögels & Brechman-Toussaint, 2006) or chronic pain (Higgins et al., 2015; Lewandowski, Palermo, Stinson, Handley & Chambers, 2010), as

well as amongst higher pain catastrophizing parents of children with chronic pain (Jastrowski Mano, Khan, Ladwig & Weisman, 2011); however, this study extends existing work by demonstrating these associations in a community sample. It is important to note that this study did not reveal any interpersonal contribution of child- or parent-reported family functioning to the other individuals' anxiety or pain catastrophizing. One prior study has reported associations between poorer family functioning reported by parents and higher levels of trait pain catastrophizing reported by youth with chronic pain (Jastrowski Mano et al., 2011). Findings from that prior study, as well as the current study, are in line with research indicating that children from more dysfunctional families tend to use more avoidant coping strategies (Zimmer-Gembeck & Locke, 2007), of which pain catastrophizing is a powerful example in the context of pediatric pain (Reid, Gilbert & McGrath, 1998).

This study also revealed a relation between poorer family functioning and greater parental distress in response to children's pain. This relation has never been previously identified and is an interesting avenue for further research given the number of studies that have strongly implicated greater parent self-oriented distress in maladaptive parent behaviours following child pain and an increased parental desire to restrict their children from engaging in painful activity (Caes, Vervoort, et al., 2014; Caes, Vervoort, Eccleston, Vandenhende & Goubert, 2011; Caes, Vervoort, Trost, et al., 2012). Recent research reported that high levels of parent pain catastrophizing contributed to maintaining high levels of distress of parents whose children with cancer underwent repeated painful procedures, whereas levels of parent distress decreased in low pain catastrophizing parents over time (Caes, Goubert, et al., 2014). Given that poorer family

functioning as reported by parents was associated with both greater parent trait pain catastrophizing and distress in the current study, it is possible that poor family functioning may also contribute to maintaining high levels of parent distress in response to children's pain over time. This is an area worthy of future research attention.

Perhaps the most interesting findings from this research were the observed aspects of family functioning implicated in children's verbal behaviours during child pain, as they showed greater symptom complaints by children from less negative/conflictual and less cohesive families, and with greater parent emotional support and shared family responsibility for family problems. Although not empirically tested in this study, greater symptom complaints by children typically co-occur with increased pain and distress (Spagrud et al., 2008). Thus, these findings might suggest that healthier functioning families are engaging in more maladaptive parent-child interactions likely to result in increased child pain; however, no significant findings were found between observed family functioning and parent responses, which also contribute to increasing maintaining children's pain and distress (Martin, Chorney, Cohen & Kain, 2013; Taylor et al., 2011). Previous studies in pediatric chronic pain have reported counterintuitive relations between greater family harmony or less conflictual parent-child relationships and worse child pain (Logan, Guite, Sherry & Rose, 2006; Schanberg, Keefe, Lefebvre, Kredich & Gil, 1998), with the latter study reporting stronger links between child pain and functional disability in children who had closer and more supportive relationships with their parents (Logan et al., 2006). The authors suggest this may reflect a developed closeness as a result of the shared experience of chronic pain, or alternatively a greater dependence on parents who extend their caretaking role, potentially impeding

development of appropriate child autonomy and coping. Their latter interpretation is consistent with a more family-centered understanding of family problems predicting greater symptom complaints as observed in the current study, as it potentially reflects a communal coping approach to managing child pain in that parents understand the child's pain to be a family issue (Lyons, Mickelson, Sullivan & Coyne, 1998). However, this is inconsistent with previous reports that poorer, not healthier, family functioning was associated with a greater parental sense of responsibility for child chronic pain (Guite, Logan, McCue, Sherry & Rose, 2009). Greater family cohesion is typically considered indicative of healthier functioning families, as it reflects a greater sense of unity, togetherness, warmth, and closeness within the family (Alderfer et al., 2008). Thus, it was unexpected to observe lower family cohesiveness amongst a pattern of more generally adaptive aspects of family functioning in relation to greater child symptom complaints. The implications of this finding are unclear. However, given that higher levels of cohesiveness have been associated with greater fear of negative evaluation amongst highly anxious children (Bögels & Brechman-Toussaint, 2006), it is possible that lower family cohesiveness allowed children in the current study to share more openly their difficulties coping with pain without fear of parental criticism or judgment. Furthermore, greater family cohesiveness predicted higher rates of the other talk code by children during pain. This code includes coping statements by the child, as well as engagement in talk unrelated to the current pain experience. Thus, this may more clearly capture the expected relation between greater family cohesiveness and more adaptive child coping with pain. Overall, it is clear that many surprising and conflictual results are apparent in the small amounts of previous related research available, and that many

proposed interpretations are highly speculative. Although this research suggests that parent-child behaviours in response to child pain occur within the context of broader parent-child relationships and interactions, more research is needed to disentangle these likely complex relations.

Although this study focused on poor family functioning as a vulnerability factor, another potential conceptualization of the role of family functioning in child pain is as a protective or resilience factor, potentially moderating relations between children's dispositional vulnerability and pain adaptation (Ashby Wills, Blechman & McNamara, 1996; Kliwer et al., 1994; Sturgeon & Zautra, 2013a). This may provide new insight into some of the counterintuitive findings described above. Children from more supportive, warm, predictable, and connected family environments have been reported to appraise stressors as less threatening and to use more adaptive coping strategies in response to stress (Ashby Wills et al., 1996; Kliwer, Fearnow & Miller, 1996; Zimmer-Gembeck & Locke, 2007). Furthermore, communal coping approaches by families may contribute to resiliency in response to stressors (Lyons et al., 1998). Although most studies report significantly poorer functioning in families of children with chronic pain (Lewandowski et al., 2010), not all children with chronic pain have dysfunctional families (Scharff et al., 2005), and adaptive family environments have been reported to weaken associations between increased pain and disability (Logan & Scharff, 2005). A future focus on family strengths may inform additional treatment efforts that build on families' existing competencies (Kazak, Simms & Rourke, 2002).

No relations were found in the current study between family functioning and children's pain outcomes. This is consistent with some previous studies of pediatric

chronic pain (Guite et al., 2009; Lewandowski & Palermo, 2009), but different from others which have found significant relations, although the direction of reported effects are inconsistent (Lewandowski et al., 2010). Specifically, higher levels of intrafamily control and family harmony have been associated with increased pain, whereas greater family expressiveness and parent-child relationship distress have been associated with decreased pain (Logan et al., 2006; Ross et al., 1993; Schanberg et al., 1998). It may be that in a community sample, general family functioning is too distally implicated, exerting its influence through more proximal factors such as parent-child interactions, whereas general family functioning is more entwined in the continuous daily experience and management of chronic pain. Studies reporting significant findings also used different and more comprehensive self-report measures of family functioning than the Brief FAM used in the current study (Logan et al., 2006; Ross et al., 1993; Schanberg et al., 1998). However, taken together with the significant findings implicating aspects of observed family functioning in children's symptom complaints, results from the current study suggest that the family environment is impacting children's verbal expressions of pain, but not their reported experience of pain.

An important consideration when integrating across studies of family functioning in pediatric pain is the potential contribution of different assessment measurements to discrepant findings. This issue has been raised before (Lewandowski et al., 2010) and is supported by the emergence of different findings depending on self-report versus observational assessment in the current study. Future research should use multi-informant multi-method assessment and select high quality measures of family functioning that have been employed in previous studies in pediatric pain and pediatric psychology

(Alderfer et al., 2008; Holmbeck et al., 2002; Lewandowski et al., 2010). This will improve the comparability of findings to existing research, while also providing comprehensive and rigorous empirical examination.

4.3 STRENGTHS AND LIMITATIONS

4.3.1 Multi-Informant Multi-Method Design

A major strength of this dissertation was its use of multi-informant multi-method assessment, particularly related to family functioning, as well as its inclusion of observational coding of parent-child behaviours during child pain. Measuring family functioning using questionnaire self-report from both children and parents, as well as observational coding during a conflict discussion task, significantly improved upon previous research of family functioning in pediatric pain, which relies predominantly on self-report provided by a single family member (Lewandowski et al., 2010). The value of this rigorous and resource-intensive approach was clearly seen in the current study, which revealed unique findings depending on the informant (child or parent) or aspects of family functioning as captured during observation. This is consistent with recommendations to use multi-informant multi-method approaches as children and parents often hold differing perspectives of the family, and self-report and observed measures of family functioning are typically only modestly related (Alderfer et al., 2008; Holmbeck et al., 2002). However, the availability of data derived from multiple sources using multiple methods resulted in a larger number of analyses in the current study. This could have increased Type I error in the current study; however, attempts were made to mitigate any potential for spurious findings by selectively conducting analyses to address primary research questions only.

4.3.2 Observational Assessment

In addition to its value as part of a multi-method study design, observation of parent-child interactions affords less subjective assessment of family functioning (Alderfer et al., 2008; Ginsburg, Siqueland, Masia-Warner & Hedtke, 2004) and reporting of behaviours during child pain, of which parents are generally inaccurate (Cohen, Manimala & Blount, 2000). It has also been suggested that observational coding has natural clinical applicability given the ease of identifying specific relevant behaviours for treatment (Lindahl & Malik, 2001). Use of the SCIFF to capture aspects of family functioning as seen during a conflict discussion task was well matched given its original development for application during family problem discussions (Lindahl & Malik, 2000). The SCIFF has also been used with mixed ethnicity families and is relevant across various family constellations, supporting its reliability and applicability across participating dyads (Lindahl & Malik, 2001). Furthermore, selection of parent and child codes during the CPT captured behaviours of interest associated with child and parent pain coping and afforded easy comparison to previous work (Caes, Vervoort, Trost, et al., 2012; Moon, Chambers & McGrath, 2011; Vervoort, Caes, Trost, et al., 2011; Walker et al., 2006; Williams et al., 2011). The groupings of the subcodes at the broader code level were theoretically derived. Within broader categories, subcodes showed consistent and expected relations with relevant child and parent outcomes, offering additional empirical support for the selected groupings (Bakeman & Gottman, 1997).

However, the advantages of the selected coding systems are balanced by several drawbacks. The observational codes used to capture parent and child behaviours during child pain focus on the content of verbalizations and do not capture the verbal tone or

other non-verbal behaviours, which can also serve to communicate pain, distress, or support (Caes, Vervoort, et al., 2014; Goubert et al., 2005; Hadjistavropoulos & Craig, 2002), or alter the impact of behaviours (McMurtry, Chambers, McGrath & Asp, 2010). Although consistent with previous research (Moon et al., 2011), it is possible that subcodes lump together behaviours that serve different functions. For example, the subcode ‘symptom-focused talk’ (part of broader category of parent pain attending talk) includes all parent talk to the child that refers to their current physical symptoms (cold or pain), anxiety, cold pressor-related status or resistance, and combines both questions about the child’s status (e.g., “does it hurt?”), as well as commands to cope (e.g., “hold my hand”) within the single subcode. While combining all pain-focused talk by parents has been taken by several previous research groups and has shown significant findings with children’s pain experience (Caes, Vervoort, Trost, et al., 2012; Moon et al., 2011; Vervoort, Caes, Trost, et al., 2011; Walker et al., 2006), it may inadvertently obscure parent behaviours that elicit greater child pain and distress (e.g., symptom-focused questions) with those that may encourage successful coping in some children (e.g., symptom-focused commands to cope).

The application of rigorous recommended approaches for training coders resulted in satisfactory to excellent interrater agreement for most codes across both interactions tasks (Yoder & Symons, 2010); however, several codes of family functioning necessitated being omitted due to inadequate interrater agreement. This may have been due to the restricted range of several codes (e.g., parent withdrawal) or the socially based nature of several codes (e.g., parenting style), which require greater judgment in considering the function of behaviours rather than merely its presence or absence (Yoder

& Symons, 2010). Furthermore, despite being identified as rigorous, relatively few publications report findings using the SCIFF, and often report only a subset of codes, limiting comparison of this study's findings to previous work (Alderfer et al., 2008; DeBoard-Lucas, Fosco, Raynor & Grych, 2010; Kitzmann, 2000; Lindahl, 1998; Lindahl & Malik, 1999).

4.3.3 Lab-Based Methodology

Use of lab-based methods offers many strengths, including standardization and feasibility of observing parent-child interactions with larger samples (Birnie, Caes, Wilson, Williams & Chambers, 2014; Ginsburg et al., 2004). Collection of data from a community-based sample in the lab contributed to the relatively large sample size in the current study with sufficient statistical power to detect small to medium effects. An additional advantage of more structured experimental tasks is an increased likelihood of eliciting behaviours of interest and the detection of individual differences by holding other contextual variables stable (Kerig & Lindahl, 2001; Yoder & Symons, 2010). Although observation in a real world setting is more ecologically valid, it offers a greater likelihood that unmeasured contextual variables are influencing study findings in some unknown way (e.g., variations in painful stimuli, previous experience with pain stimuli, setting, presence of other individuals). Furthermore, social desirability may have been minimized in the current study by the use of a task explicitly directing parents and children to discuss conflict (Kerig & Lindahl, 2001).

That being said, the artificial lab environment can also influence parent and child behaviours (Kerig & Lindahl, 2001). Efforts were made to minimize this as much as possible in the current study, including furniture and decor to make the space less

“clinical”, leaving the parent and child alone during the interaction tasks, and by encouraging them to interact as they normally would as directed in the task instructions. Including the typicality of others’ behaviour measures provided some assessment of how similar the observed interactions are to those in the real world, and findings indicated that that children and parents generally perceived the other to be acting ‘only a little different’ than usual. Furthermore, wide variability was seen in the observational coding of family functioning and parent-child behaviours. Despite the inherent limitations, this suggests some evidence in support of the external validity of observed parent-child behaviours during these tasks.

Although the CPT has been extensively used to study pain in children with and without recurrent pain (Birnie, Petter, Boerner, Noel & Chambers, 2012; von Baeyer, Piira, Chambers, Trapanotto & Zeltzer, 2005), there is surprisingly little evidence informing its relation to real world pain experiences (Birnie, Caes, et al., 2014). One study has reported that higher pain intensity ratings following the CPT were predictive of greater school absences amongst a group of healthy 8-10 year olds (Tsao, Glover, Bursch, Ifekwunigwe, & Zeltzer, 2002). No study has directly compared children undergoing the CPT and clinical acute pain or chronic pain, however a recent experimental study asked healthy children aged 8-14 years to compare the CPT to their last needle procedure (Boerner et al., 2015). In that study, children reported being “a little less nervous” and the CPT as being “a little less scary” than a previous needle procedure, with higher pain catastrophizing children reporting the CPT to be more comparable to a needle in terms of their nervousness and fear. Overall, children indicated pain from the CPT to be the same or only slightly less painful than a previous needle procedure, with older children

reporting it to be more comparable (Boerner et al., 2015). Additional research with adults suggests that the CPT may be better suited for studying pain catastrophizing as compared with other experimental pain paradigms, as self-reported pain intensity was differentially sensitive to levels of trait pain catastrophizing during the CPT but not during other experimental thermal or mechanical stimulation (Kristiansen et al., 2014). Furthermore, consistent relations have also been found between child and parent pain catastrophizing and children's pain across both lab-based studies using experimental pain paradigms with healthy children and children with chronic pain, and studies of clinical pain (Caes, Vervoort, et al., 2014; Caes et al., 2011; Vervoort et al., 2008; Vervoort, Goubert, & Crombez, 2009), suggesting that observed relations in the current study have relevance and applicability to real world situations. However, given the lack of empirical assessment of the ecological validity of the CPT, replication of findings in the current study in the context of clinical acute and chronic pain are warranted. Future investigations could apply similar methodologies and observe parent-child interactions during a medical procedure and/or in the home environment.

Another study limitation was that significant order effects for parent-child interactions tasks had to be controlled for, with children who completed the conflict discussion task prior to the CPT reporting greater state pain catastrophizing and pain intensity during the CPT. While this could indicate some unmeasured carryover effect from the parent-child discussion, this seems unlikely given that no differences were observed in talk during the CPT (which one might expect if they were continuing to discuss the conflict), and these children were not more distressed following the conflict discussion task as compared to children who completed the CPT prior to the conflict

discussion task. The significant order effects could be a result of some unmeasured impact of the conflict discussion task (e.g., fatigue) that directly contributes to greater state pain catastrophizing and pain intensity, or that primes children to be more strongly impacted by interactions during the CPT that result in poorer pain. It is also possible that children and/or parents were significantly different on another unmeasured variable that impacted child reports of state pain catastrophizing and pain intensity, but not observed behaviours.

4.3.4 Self-Report by Parents and Children

As compared to most previous related research, this study assessed a number of matched individual factors and outcomes in both children and their parents (i.e., anxiety, pain catastrophizing, distress, ratings of child pain). These variables have all previously been identified as relevant to child and parent behaviours and perceptions of children's pain, but have rarely been concurrently considered. This approach afforded application of the actor-partner interdependence model as a multilevel statistical approach for exploring intra- and inter-personal influences in dyads (Kenny, Kashy & Cook, 2006). Despite the growing popularity of APIM and its ideal suitability to examining parent-child dyads, very few examples of its application in pediatric pain and health have been published to date (Driscoll, Schatschneider, McGinnity & Modi, 2012; Fales, Essner, Harris & Palermo, 2014).

This represents an important improvement over previous work in pediatric pain, which has often examined the influence of related child and parent factors in separate analyses (e.g., Vervoort, Goubert, et al., 2011). Ignoring non-independence can lead to overly liberal or overly conservative tests of statistical significance depending on the

nature of non-independence (Kenny et al., 2006). More specifically, the chance of Type I errors increase when the independent variable is between dyads and is positively correlated or when the independent variable is within dyads and is negatively correlated; whereas the chance of Type II errors increase in situations where the independent variable is within dyads and is positively correlated or when the independent variable is between dyads and negatively correlated (Kenny et al., 2006). Collection of self-report data can result in missing data. Analysis of missing data in the current study indicated that <1% of child and parent-reported data was missing. Little's (1988) missing completely at random test was not significant, $\chi^2 = 5039.60$ ($df = 4904$, *ns*), suggesting data was missing completely at random (i.e., no identifiable pattern for missing data). The expectation maximization method was used to estimate values for missing data (Tabachnick & Fidell, 2001).

A strength of the study was a representative range of child trait catastrophizing, with comparable numbers of children reporting low ($n=58$; 33.9%), moderate ($n=49$; 28.7%), and high ($n=64$; 37.4%) levels of trait pain catastrophizing based on clinical reference points developed with children with chronic pain (Pielech et al., 2014). Additionally, just over a third of children (24.5%; $n=59$) reported trait anxiety in a clinically significant range, reliably discriminating children with diagnosed anxiety disorders from those without (Birmaher et al., 1999). Wide variability was also observed in child and parent-reports of child pain outcomes. However, the use of a community-based sample, as well as the less stressful nature of the CPT, likely contributed to the limited variability of a minority of study variables (i.e., generally lower levels of parent trait anxiety, and child and parent distress following the CPT). Use of parametric tests in

the current study were still considered appropriate given the large sample size (i.e., >40 participants) and focus on individual differences rather than between group comparisons (Ghasemi & Zahediasl, 2012; Treister et al., 2015).

The study sample included greater racial and ethnic diversity than is typical for the general local population (Statistics Canada, 2013) and some previous studies (Noel et al., 2015), but not others (Wilson et al., 2014). Parents in the study were more highly educated and earned a higher annual household income than the general population and previous research (Statistics Canada, 2013; Vervoort, Goubert, et al., 2011; Wilson et al., 2014), but appeared comparable to some studies of children undergoing surgery (Noel et al., 2015) or with chronic pain (Logan & Scharff, 2005; Logan et al., 2006). It is also possible that families who are particularly poor functioning or have very high levels of conflict self-selected out of study participation. Indeed, scores on child- and parent-reported family functioning questionnaires indicated that most participating families fell into the average to excellent range of family functioning, with 7-11% in the increasing problems to problematic range (Skinner, Steinhauer & Santa-Barbara, 1995). The Brief FAM provided only a broad overview of perceived family functioning, and future research may capture more subtle relations with child pain using more detailed and nuanced self-report measures of the family (Alderfer et al., 2008), as well as oversampling from the poorest functioning families (Whisman & McClelland, 2005).

One additional limitation is the minimal available information on the psychometric properties of several self-report measures used in the current study, particularly related to assessment of child and parent state pain catastrophizing and child situational distress. Despite being developed from well-validated and reliable trait

measures (Crombez et al., 2003; Goubert, Eccleston, Vervoort, Jordan & Crombez, 2006) and used in previous research (Boerner et al., 2015), the psychometric properties of the child and parent state pain catastrophizing measures have not been formally explored. Internal consistency of the scales was acceptable in the current study, with Cronbach's alphas of .79 and .76 for the child and parent state pain catastrophizing measures, respectively. Significant positive correlations with trait versions of the respective parent and child trait pain catastrophizing measures, as well as relations with other study variables in expected directions, offers preliminary support for measure validity. The measure of child self-oriented situational distress was developed for the purposes of the current research, and has never been used elsewhere. It was created as a more comprehensive and multi-faceted assessment of child distress, as compared to most existing self-report measures that rely on single items. Internal consistency of the children's distress questionnaire in the current study was also acceptable with a Cronbach's alpha of .78. This suggests that the items of the measure are generally assessing the same underlying construct of child situational distress. Significant positive correlations between child distress and child self-reported pain intensity ($r=.299, p<.01$) and unpleasantness ($r=.468, p<.01$) provide preliminary evidence in support of convergent validity.

4.4 THEORETICAL IMPLICATIONS

Findings from the current study have implications for a number of existing theories in pediatric pain, integrating across broader theories of child, parent, dyadic, and family factors (Evans et al., 2008; Palermo & Chambers, 2005; Palermo, Valrie, & Karlson, 2014), as well as specific processes related to pain expression and perception,

and observer responses to pain (Goubert et al., 2005; Hadjistavropoulos et al., 2011; Sullivan, 2012). This study offers empirical support for the relevance of a systems contextual perspective to considering families in children's pain, and supports the interface between individual coping, parent-child interactions, and the family, as has been discussed predominantly in the context of pediatric chronic pain (Palermo & Chambers, 2005; Palermo, Valrie, & Karlson, 2014). Our findings did not support a direct influence of parent coping or family functioning on children's perceptions of pain, more likely influencing child pain indirectly via parent-child interactions. Although a mediation model was not formally tested in this study, parent state pain catastrophizing and aspects of family functioning were significantly implicated in dyadic interactions, providing supportive evidence in favour of this indirect pathway. Furthermore, the findings highlight that the interpersonal context of parent and family factors appear most relevant to children's verbal pain behaviours as demonstrated during parent-child interactions.

Existing theories implicating family factors in pediatric chronic pain conceptualize a bidirectional influence between the family context and pain, with the family both impacting and being impacted by the child's pain (Palermo & Chambers, 2005; Palermo, Valrie, & Karlson, 2014). Of these two understandings, the former was considered most applicable to the current study, as experimental pain experienced at a single time point in a community-based sample does not represent a chronic stressor to which the family system must adjust. The family is understood as the context within which pain coping is learned and pain is responded to (Goubert et al., 2005; Goubert, Vlaeyen, Crombez & Craig, 2011; Kliewer et al., 1994). Significant observed predictions

from family functioning to individual trait anxiety, trait pain catastrophizing, and situational distress, as well as dyadic interactions, are consistent with this understanding.

Pain catastrophizing was identified as an important parent and child coping factor (Evans et al., 2008; Goubert & Simons, 2014). Findings offered some specificity regarding the unique contribution of child state pain catastrophizing to parent perceptions of child pain, in addition to the parents' pain catastrophizing. Existing models suggest that this influence occurs via its impact on child pain expression (Goubert & Simons, 2014; Hadjistavropoulos et al., 2011), although that was not formally tested here. Findings from the current study are consistent with the interpersonal fear avoidance model of pediatric pain that identifies an impact of parent pain catastrophizing on parents' decoding of the child's pain, but neglects to identify a direct impact of parent pain catastrophizing to children's pain expression, as was found in the current study (Goubert & Simons, 2014; Simons, Smith, Kaczynski & Basch, 2015).

The observed associations between high levels of child pain catastrophizing and increased verbal pain expression in this study are consistent with the communal coping model of catastrophizing which suggests that individuals with high levels of pain catastrophizing may engage in greater expressions of pain in an effort to elicit support from others (Sullivan, 2012). However, the study's findings also extends this model by suggesting that greater pain catastrophizing by parents about the child's pain contributes to greater expressions of pain by children with low levels of pain catastrophizing. This is consistent with a communications model of pain that recognizes that individuals modulate pain expression based on their social environment (Hadjistavropoulos et al., 2011). The greater pain expression by children with low levels of state pain

catastrophizing only in dyads with parents reporting high levels of state pain catastrophizing could also reflect observational learning and social modeling of pain (Goubert, Vlaeyen, Crombez & Craig, 2011). Findings relating aspects of family functioning to child expressions of pain were also suggestive of communal coping in pain (Lyons et al., 1998), implicating family factors, in addition to pain catastrophizing, in the interpersonal context of pain communication.

Although most models do not distinguish between state or trait catastrophic thoughts about pain (Evans et al., 2008; Goubert & Simons, 2014; Sullivan, 2012), different patterns of association between state and trait pain catastrophizing with dyadic versus family factors in this study suggest that distinction is relevant for application of these models to a variety of pain experiences.

4.5 CLINICAL IMPLICATIONS

Although the current study was conducted in the lab using experimental pain, its findings have likely clinical application. Findings from the current study indicate that health professionals should consider characteristics of both children and parents, and the family context, when managing children's pain. This is particularly warranted if parents will be present with the child during the pain experience and/or if they will be relied on to provide proxy ratings of the child's pain.

Health professionals should assess children's and parents' tendency to catastrophize about child pain generally (trait), as well as about specific painful experiences (state). Although greater state pain catastrophizing by children places these dyads at greater risk for more maladaptive pain-promoting interactions during child pain, health professionals should also consider the match between level of child and parent

state pain catastrophizing. Specifically, being aware that a child reporting low pain catastrophizing who is with a parent reporting high pain catastrophizing is more likely to express their pain, placing them also at-risk for pain-promoting interactions and increased pain. Higher ratings of child pain by parents and children could also indicate greater levels of child and parent trait and/or state pain catastrophizing that can inform treatment decisions.

Distraction interventions are generally found to be effective for reducing child acute pain and distress (Birnie, Noel, et al., 2014; Uman et al., 2013), and are likely to be most beneficial for children reporting low levels of pain catastrophizing. Although research suggests that distraction may be ineffective, and potentially increase experienced pain, for children with high pain catastrophizing (Verhoeven, Goubert, Jaaniste, Van Ryckeghem & Crombez, 2012), it has shown benefit with enhanced motivation, such as the opportunity to earn money for performance on a distraction task during the CPT (Verhoeven et al., 2010). Given their susceptibility to increased distress, parents who report poor family functioning and high levels of state pain catastrophizing or trait anxiety should not be called upon to provide distraction for their children, as research suggests they are likely to be less effective (Caes, Vervoort, et al., 2014; Dahlquist & Pendley, 2005; Dahlquist, Power, Cox & Fernbach, 1994). Children with low pain catastrophizing with a parent reporting high pain catastrophizing or high anxiety may benefit more from distraction provided by someone other than their parent (e.g., nurse). Strategies intended to focus attention on pain in an adaptive way (e.g., mindfulness-based interventions) (Petter, McGrath, Chambers & Dick, 2014; Prins, Decuypere & Van Damme, 2014), or restructure catastrophic thoughts and use positive self-talk (e.g.,

cognitive-behavioural interventions) (Kashikar-Zuck et al., 2013), may be better suited for individuals with high levels of pain catastrophizing given their propensity to attend to pain given increased perceived threat (Eccleston & Crombez, 1999; Vervoort, Caes, Trost, Notebaert & Goubert, 2012). Children with high levels of pain catastrophizing may also benefit from learning more adaptive ways to express a need for additional support from their parents, such as making verbal requests for support (Sullivan, 2012). Parents are likely to also benefit from these intervention approaches, although to our knowledge no study has specifically assessed the impact of any intervention on parent state or trait pain catastrophizing. These are areas in need of further research.

Given the study's findings, greater benefit is likely to come from interventions that specifically target state, rather than trait, pain catastrophizing by children and parents. Only one study with healthy adults has tested two brief interventions to reduce pain catastrophizing, comparing a pain education group to a group that additionally engaged in cognitive strategies (Terry, Thompson & Rhudy, 2015). Cognitive strategies included pain control statements (e.g., "this hurts, but I have the control"), with imaginal rehearsal prior to undergoing the painful stimuli. Both groups showed reductions in state pain catastrophizing, although a significantly greater reduction was seen in the group also using cognitive strategies. Reductions in pain catastrophizing explained treatment benefits of improved pain intensity and unpleasantness (Terry et al., 2015). This type of intervention has promise and high clinical utility given its relative brevity (~30 minutes), although more research is needed specific to children experiencing clinical acute or chronic pain and their parents, and to determine whether benefits are long lasting or generalize to other painful experiences.

Although trait pain catastrophizing showed few direct associations with child and parent pain behaviours, it remains a worthy target for treatment as it predisposes children and parents to greater state catastrophizing (Boerner et al., 2015; Sturgeon & Zautra, 2013a), and can exacerbate associations between state pain catastrophizing and pain intensity, as demonstrated in adults with chronic pain (Sturgeon & Zautra, 2013b). Longer multi-session cognitive behavioural interventions have successfully reduced levels of trait pain catastrophizing among children with chronic pain (Kashikar-Zuck et al., 2013), mediating the beneficial effects of treatment on symptom reduction in children with functional abdominal pain (Levy et al., 2014). These lengthy interventions are likely impractical and too resource intensive for infrequent acute pain experiences, but may warrant consideration for repeated experiences, such as frequent medical procedures, and/or for children with very high levels of pain catastrophizing. Brief interventions, such as repeated positive coping statements, do not appear effective for reducing trait pain catastrophizing as examined with adults completing the CPT (Bialosky, Hirsh, Robinson & George, 2008).

This study suggests that health professionals can glean important information about family functioning both from asking children and parents directly, as well as observation of natural family interactions. Evidence of poorer family functioning should cue toward greater child and parent dispositional vulnerability to poor pain coping (i.e., trait anxiety and trait pain catastrophizing), and increased likelihood for parental distress, suggesting that these children may require additional supports from others. However, this study also suggests that seemingly well-functioning families could also be at risk for pain-promoting interactional patterns during child pain, particularly when parents appear

very emotionally supportive and take greater responsibility in handling family problems. These implications should be understood as very preliminary, as it is unknown whether these patterns of parent-child interaction typically associated with poorer child pain are also maladaptive in healthier functioning families. Treatment efforts in pediatric chronic pain have moved toward greater family involvement targeting non-pain specific parent behaviours and positive parent-child interactions (Palermo, Law, Essner, Jessen-Fiddick & Eccleston, 2014; Sieberg, Flannery-Schroeder & Plante, 2011); however, findings from the current study suggest treatments targeting context specific parent-child interactions are likely to be more effective for reducing child pain and distress for pain that is not recurrent, rather than treatments directed at general family processes.

Lastly, although this study speaks more directly to generally healthy children experiencing acute pain, given the growing evidence for the negative influence of child and parent trait pain catastrophizing and poorer family functioning that has been observed amongst families with children with chronic pain (Lewandowski et al., 2010; Lynch-Jordan et al., 2013), health professionals should consider that these families may be at even greater risk for worse pain coping, parent distress, and child pain outcomes.

4.6 ADDITIONAL CONSIDERATIONS FOR FUTURE RESEARCH

4.6.1 Child and Parent Sex, and Child Development

Although the current study was not designed or powered to examine such differences, future research should continue to consider child and parent sex in understanding the interplay of child and parent coping, dyadic interactions, and family factors. As compared with fathers, mothers have been reported to catastrophize more about their child's pain, as well as experience greater personal distress and empathic

concern for others in some studies (Goubert, Vervoort, Sullivan, Verhoeven & Crombez, 2008; Hechler et al., 2011), but not in others (Boerner et al., 2015; Goubert, Vervoort, De Ruddere & Crombez, 2012; Vervoort, Caes, Crombez, et al., 2011). Parents also appear to catastrophize more about pain experienced by their daughters versus their sons (Wilson et al., 2014). Sex differences in child pain catastrophizing are not always found (Pielech et al., 2014), although when observed girls tend to report higher pain catastrophizing than boys (Crombez et al., 2003; Parkerson et al., 2013). Differences have been observed in interactions during child pain between mothers and their daughters versus sons (Chambers, Craig & Bennett, 2002). Girls with chronic pain appear particularly susceptible to the negative consequences of increased parent attention to their pain as compared to boys with chronic pain or healthy children, although the vast majority of parents in that study were mothers (Walker et al., 2006). Additional research has reported that mothers' and fathers' engage in similar verbal behaviour during child pain largely, which had the same impact on children's experienced pain (Moon et al., 2011). However, other research suggests that mothers and fathers respond differently to real or hypothetical child pain based on level of child or parent pain catastrophizing (Goubert et al., 2012; Vervoort, Huguet, Verhoeven & Goubert, 2011). With regards to pain ratings, fathers have been observed to report higher pain for their sons versus their daughters, but are generally more congruent with child pain ratings as compared to mothers (Moon et al., 2008). Greater than 20% of dyads in the current study included fathers. While this represents an improvement over most research in representation of fathers (Birnie, Boerner & Chambers, 2014), the current study was insufficiently powered to explore potential differences between sex matched and mismatched parent-child dyads (i.e.,

mother-daughter, mother-son, father-daughter, father-son). Sex differences have been noted in the impact of pain models and gender role socialization about pain in children (Evans et al., 2008). Parents appear to encourage sex-typed activities in their children generally (Lytton & Romney, 1991), and tend to report both more positive and negative behaviours from their children of the opposite sex (Leve & Fagot, 1997). Parents also tend to be more restrictive and engage in more physical punishment with their sons as compared with daughters (Lytton & Romney, 1991). The lower family cohesiveness and child positive affect, and greater child withdrawal observed in the current study for dyads with sons may be reflective of those tendencies, although they were not directly assessed in this study. Taken together, the sex differences observed in the current study for parents and children in reported and observed family functioning, as well as previous research, suggest that reported gender role socialization of children, and the differential roles of mothers versus fathers, in families are also relevant (McGoldrick et al., 2011).

The most recent iteration of a family theory in pediatric pain places heavy emphasis on the developmental context within which child, parent, and family factors should be considered (Palermo, Valrie, & Karlson, 2014). Observed associations between child age and child pain outcomes, parent-child interactions, and aspects of family functioning in the current study, reinforced the relevance of developmental factors. Although this study was cross-sectional and focused on school-aged children and their parents, other developmental frameworks relating to child coping (Skinner & Zimmer-Gembeck, 2007), child pain responding (Birnie, Parker & Chambers, 2014; Boerner, Birnie, Caes, Schinkel & Chambers, 2014), parent-child relationships (Collins & Russell,

1991; Paikoff & Brooks-Gunn, 1991), and typical family life cycles (McGoldrick et al., 2011) should be considered.

4.6.2 Parent Pain

An additional parent factor worthy of consideration in future research is parental chronic pain status (Evans et al., 2008). Pain tends to aggregate in families (Higgins et al., 2015; Hoftun, Romundstad & Rygg, 2013), and although not all children who have a parent with chronic pain will develop recurrent pain themselves, parents are central figures from whom all children learn to cope with, express, and respond to pain (Goodman & McGrath, 2003; Goubert et al., 2011; Osborne, Hatcher & Richtsmeier, 1989). Children of parents with chronic pain have poorer health outcomes, poorer social functioning, and increased externalizing and internalizing problems, including anxiety (Evans, Keenan & Shipton, 2007; Evans, Shipton & Keenan, 2006; Higgins et al., 2015). Family functioning is also poorer in families with parents with chronic pain (Evans et al., 2006; Higgins et al., 2015; Smith & Chambers, 2006). More specific influences on pain coping are reported, with parent chronic pain predicting greater pain catastrophizing in a community sample of adolescents (Wilson et al., 2014). Adults with chronic pain report higher levels of comorbid anxiety and depression as compared to individuals without chronic pain (Gormsen, Rosenberg, Bach & Jensen, 2010), with mothers with chronic pain reporting more difficulties with daily parenting tasks, such as caring for children, as compared with their healthy counterparts (Evans et al., 2006). Altogether, these studies suggest that presence of parental chronic pain places children at increased risk for poor pain coping, even when children do not have chronic pain themselves, as well as decreasing the likelihood that the parent will be able to support them in an adaptive way.

4.6.3 Study Design and Analysis

In addition to those used in the current study, a number of other study design and data analytic strategies should be considered for future research using multi-informant multi-method and dyadic data derived from families. This dissertation chose to handle child and parent reports and observational assessment of family functioning in disaggregated form given the theoretical and empirical interest in their unique perspectives, and the minimal correlations amongst them (Holmbeck et al., 2002). However, there are a number of other strategies for handling similar data, including aggregation of data across sources or methods by summing or latent variable modeling, or examining discrepancies between sources or methods (Holmbeck et al., 2002; Ledermann & Kenny, 2012). The relevance of the discrepancy approach has already been shown with greater incongruence between parent and child reports of family functioning associated with greater impairment in children with fibromyalgia (Schanberg et al., 1998). Recent investigations have integrated micro- and macro-coding of parent behaviours and communication within the same parent-child interaction in pediatric cancer (Rodriguez et al., 2013) and spina bifida (Murray et al., 2015). This simultaneous application of multiple methods of observational coding has the potential to provide richer and more clinically informative data regarding content, frequency, intensity, and quality of observed behaviours. Increasing use of sequential analysis with observed parent-child interactions should also be considered for future research (Bakeman & Gottman, 1997; Chorney, Garcia, Berlin, Bakeman & Kain, 2010), as its relatively few applications in pediatric pain have revealed novel nuances in the bidirectional influences and function of parent and child behaviours during acute pain (Taylor et al., 2011). Use

of the actor-partner interdependence model to dyadic data has many advantages, although it is potentially limited by testing only one direction of actor and partner effects from specified predictor to outcome within one identified dyad in a family. Several other dyadic data analytic approaches allow additional relations to be tested (i.e., direct influence between outcomes in a mutual influence model), or for interpersonal effects to be tested between all family members simultaneously (i.e., the social relations model) (Cook, 2001; Kenny et al., 2006).

4.7 ADDITIONAL CHALLENGES

4.7.1 Relevance of General Parenting to Pediatric Pain

One additional objective of this dissertation was initially to examine general parenting strategies in the context of pediatric pain, which have received very minimal research attention to date (see Dahlquist et al., 1994 for an example). Parenting as examined amongst anxious parents and/or anxious children offered relevance to pediatric pain given theoretical and empirical overlap between pain catastrophizing and anxiety, and the influence of general anxiety in children's pain (Fisher, Caes, Clinch, Tobias & Eccleston, 2015; Link & Fortier, 2015; Vervoort, Eccleston, Goubert, Buysse & Crombez, 2010). Based on a meta-analysis of parenting and child anxiety, five core dimensions of general parenting were identified, comprised within two broad categories of parental control (i.e., over-involvement and autonomy-granting) and rejection (i.e., withdrawal, aversiveness, and warmth) (McLeod, Wood & Weisz, 2007). Parental control, and more specifically, autonomy-granting, have been strongly associated with child anxiety as shown in two meta-analyses (McLeod et al., 2007; van der Bruggen, Stams & Bögels, 2008). Parents of anxious children tend to be less autonomy granting,

less warm, and more intrusive and negative during parent-child interactions (McLeod et al., 2007; van der Bruggen et al., 2008), whereas anxious parents tend to be less productively engaged, more withdrawn and disengaged during parent-child interactions (Woodruff-Borden, Morrow, Bourland & Cambron, 2002). The tendency of anxious parents to either withdraw or to exert greater control during challenging parent-child interactions (van der Bruggen, Bögels & van Zeilst, 2010) mirrors theorized responses by highly distressed parents during child pain who may differentially respond with withdrawal or control based on primary motivations to reduce their own distress versus out of concern for the child (Eccleston & Crombez, 1999; Goubert et al., 2005). Furthermore, parenting responses, including lack of warmth and child autonomy, or overinvolvement, can lead children to perceive their environment and pain experience as hostile and threatening. This, in turn, could encourage a lack of perceived competence and reinforce avoidance of future challenges and potentially painful experiences.

Given this rationale, the initial plan for this dissertation was to code both parent-child interactions during the CPT and the conflict discussion task for the five general parenting behaviours of interest (i.e., warmth, autonomy-granting, aversiveness, overinvolvement, and withdrawal). A coding system was identified that had been applied to examine interactions between anxious children and/or anxious parents (Williams, Kertz, Schrock & Woodruff-Borden, 2012). This coding system was selected over other existing behavioural coding systems of parenting behaviours, given that it focused on all five parenting behaviours of interest. Many other existing behavioural coding systems were very complex, required significant training, and included only some or none of the parenting behaviours of interest (Alderfer et al., 2008; Kerig & Lindahl, 2001).

However, in order to be mutually exclusive and exhaustive, the identified coding system included over 40 unique codes and required utterance-by-utterance coding of all parent and child verbalizations (Williams, Kertz, et al., 2012). Given the resource intensive nature of micro-coding, as well as the realization that this level of detail was not required to address the dissertation's original objectives, a decision was made with the dissertation committee to modify this existing coding scheme to comprise only five global codes (one for each parenting behaviour), meaning that one level for each parenting behaviour was assigned for the entire parent-child interaction. Modification of an existing coding system was necessary as no macro-coding system was identified that included all five parenting behaviours of interest (Alderfer et al., 2008; Kerig & Lindahl, 2001).

4.7.2 Challenges to Modification of Existing Coding Systems

While it was not the initial goal of this study to develop a behavioural coding system, efforts to modify existing coding systems followed recommended steps outlined for such a process (Chorney, McMurtry, Chambers & Bakeman, 2015; Yoder & Symons, 2010). The research question had already been refined, identifying who to code, what behaviours were of interest, when and how to observe, how to record the behaviours, the analytic plan, and resource constraints. Next a list of codes was developed to match the five parenting behaviours of interest (i.e., warmth, autonomy-granting, aversiveness, overinvolvement, and withdrawal). Operational definitions for each parenting behaviour were taken from a meta-analysis of each behaviour in relation to child anxiety (McLeod et al., 2007), with additional examples of specific behaviours taken from the existing micro-coding system used to assess the same parenting dimensions in anxious children and/or parents (Williams, Kertz, et al., 2012). For example, parental aversiveness

included examples of criticism of the child, showing disapproval or disagreement with the child, and so on. This approach was taken in an effort to ensure validity of the developed codes.

Scoring for the modified coding system was modeled after another validated macro-behavioural coding system used to assess family functioning as observed during parent-child interactions (the System for Coding Interactions and Family Functioning; SCIFF) (Lindahl & Malik, 2000; 2001) with each parenting behaviour rated separately on a five point Likert scale from 1 ('very low') to 5 ('high'). Like the SCIFF, definitions specific to each point on the Likert scale for each parenting behaviour were provided, taking into account the frequency, intensity, and duration of observed parenting behaviours. Some consistent wording was included across all parenting behaviours. Initially, parent behaviours would be coded for the conflict discussion task in its entirety, and for three separate phases of the cold pressor task, including a one minute period prior to the initial immersion of the child's hand in the cold water (pre-CPT phase), while the child's hand was immersed in the water up to a maximum of four minutes (during CPT phase), and a one minute period following the child's removal of their hand from the cold water (post-CPT phase).

Piloting of the coding system by the lead researcher and a naïve coder led to two major refinements (Chorney et al., 2015; Yoder & Symons, 2010). Initially, identical definitions were provided for each scoring level across all parenting behaviours. A recommendation was made to include definitions specific to each parenting behaviour to increase clarity. A second refinement was to code all phases of the parent-child interaction during the CPT together. Providing separate ratings of the various phases of

the CPT was deemed to be too difficult given the limited verbalizations that are sometimes made during a one-minute waiting period.

Two coders were trained in implementation of the coding system (Chorney et al., 2015). The coders had undergraduate degrees in sociology or health science. Coders were provided brief details about the relevant parent-child interactions tasks, including clear start and stop points for coding. They were instructed to code from videotapes and to watch each interaction a minimum of six times (once straight through and once focusing on each of the parenting behaviours, respectively). Although focusing on parent behaviours, coders were instructed to also pay attention to the content of the child's verbalizations, and the context of the conversation. The lead researcher who developed the coding system went over the definitions and examples of each parenting behaviour with each coder. As part of training in use of the coding system, the coders then independently coded 6 selected parent-child interactions, three from each of the two parent-child interactions tasks (i.e., conflict discussion task and cold pressor task); the lead researcher also coded these same interactions. Coders were given a coding sheet to record scores and were required to provide written justifications. Each coder then met separately, and together with the lead researcher, to review the tapes, discuss codes and discrepancies.

The lead researcher began regular reliability and validity checks after the two primary coders had begun coding (Chorney et al., 2015). As is recommended, coders were unaware of which interactions were being used to assess reliability (Mitchell, 1979). These checks revealed some major concerns with reliability and validity. Although efforts were made to address these through discrepancy discussions, interrater reliability

remained inadequate after approximately 40% of parent-child interactions had been coded (ICCs=.221-.583) and construct validity was unclear given the lack of expected associations between the coding system and other measured study variables (e.g., child and parent trait anxiety). Additional approaches to handling interrater variability were explored (i.e., generalizability theory) (Stora, Hagtvet & Heyerdahl, 2013; Yoder & Symons, 2010); however, given resource constraints, a decision was made to cease coding using this modified coding system and to use existing coding systems with evidenced validity and reliability as reported in the methods and results of this dissertation.

This process revealed a number of challenges to observational coding methodologies, particularly the novel implementation of a coding system to a new parent-child interaction and the use of global codes to capture socially based behaviours. The nature of the cold pressor task may have precluded elicitation and observation of general parenting behaviours (Kerig & Lindahl, 2001). Although research suggests that non-experts coders can reliably assess family and parenting constructs (Baker et al., 2010), socially based codes require greater judgment by raters to consider the function of a behaviour, not merely its presence or absence (Yoder & Symons, 2010). By focusing on global codes and only the specified parent behaviours of interest, the intent of this modified coding system was to be less burdensome than existing coding systems of parenting behaviours; however, its inadequate validity and reliability may explain the predominance of complex family observational coding systems that require substantial training and/or a background in family process (Alderfer et al., 2008; Kerig & Lindahl,

2001). Although not successfully examined in this dissertation, investigation of general parenting behaviours in pediatric pain is an area worthy of future research.

4.8 CONCLUDING REMARKS

In summary, the two papers included herein build on existing theoretical and empirical work in pediatric pain regarding individual, dyadic, and family-level factors. This work represents an extension of the recognition of the importance of the family environment to a community-based sample. Particularly novel findings include the interpersonal role of child state pain catastrophizing in parents' ratings of child pain, as well as parent state pain catastrophizing and family functioning in children's verbal pain behaviours. Poorer family functioning was implicated in greater child and parent dispositional vulnerability to poor pain coping, and greater parent situational distress. Given examination of these factors using experimental pain, this work forms the launching off point for investigating the interplay of these factors in acute clinical pain. Findings highlight both the individual and interpersonal experience of pain, and the need to address both in assessment and treatment decisions to support families in coping with child pain.

REFERENCES

- Alderfer, M. A., Fiese, B. H., Gold, J. I., Cutuli, J. J., Holmbeck, G. N., Goldbeck, L., et al. (2008). Evidence-based assessment in pediatric psychology: Family measures. *Journal of Pediatric Psychology, 33*(9), 1046-1061. doi:10.1093/jpepsy/jsm083
- Ashby Wills, T., Blechman, E. A., & McNamara, G. (1996). Family support, coping, and competence. In E. M. Hetherington & E. A. Blechman (Eds.), *Stress, coping, and resiliency in children and families*. (pp. 107-134). New York, NY: Psychology Press.
- Bakeman, R. & Gottman, J. M. (1997). *Observing interaction: An introduction to sequential analysis* (2nd ed.). Cambridge, England: Cambridge University Press.
- Beck, A. T. & Steer, R. A. (1993). *Beck anxiety inventory manual*. Bloomington, MN: Pearson.
- Bialosky, J. E., Hirsh, A. T., Robinson, M. E., & George, S. Z. (2008). Manipulation of pain catastrophizing: An experimental study of healthy participants. *Journal of Pain Research, 1*, 35-41. doi:10.2147/jpr.s4178
- Birmaher, B., Brent, D. A., Chiappetta, L., Bridge, J., Monga, S., & Baugher, M. (1999). Psychometric properties of the screen for child anxiety related emotional disorders (SCARED): A replication study. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*(10), 1230-1236. doi:10.1097/00004583-199910000-00011
- Birnie, K. A., Boerner, K. E., & Chambers, C. T. (2014). Families and pain. In P. J. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), *Oxford textbook of paediatric pain*. (pp. 111-118). Oxford, United Kingdom: Oxford University Press.
- Birnie, K. A., Caes, L., Wilson, A. C., Williams, S. E., & Chambers, C. T. (2014). A practical guide and perspectives on the use of experimental pain modalities with children and adolescents. *Pain Management, 4*(2), 97-111. doi:10.2217/pmt.13.72
- Birnie, K. A., Chambers, C. T., Chorney, J., Fernandez, C. V., & McGrath, P. J. (2015a). *A multi-informant multi-method investigation of family functioning and parent-child coping during child pain*. Manuscript submitted for publication.
- Birnie, K. A., Chambers, C. T., Chorney, J., Fernandez, C. V., & McGrath, P. J. (2015b). *Dyadic analysis of child and parent trait and state pain catastrophizing in children's pain*. Manuscript submitted for publication.
- Birnie, K. A., Noel, M., Chambers, C. T., von Baeyer, C. L., & Fernandez, C. V. (2011). The cold pressor task: Is it an ethically acceptable pain research method in children? *Journal of Pediatric Psychology, 36*(10), 1071-1081. doi:10.1093/jpepsy/jsq092

- Birnie, K. A., Noel, M., Parker, J. A., Chambers, C. T., Uman, L. S., Kisely, S. R., et al. (2014). Systematic review and meta-analysis of distraction and hypnosis for needle-related pain and distress in children and adolescents. *Journal of Pediatric Psychology, 39*(8), 783-808. doi:10.1093/jpepsy/jsu029
- Birnie, K. A., Parker, J. A., & Chambers, C. T. (2014). Relevance of water temperature, apparatus, and age to children's pain during the cold pressor task. *Pain Practice*. Advance online access. doi:10.1111/papr.12257
- Birnie, K. A., Petter, M., Boerner, K. E., Noel, M., & Chambers, C. T. (2012). Contemporary use of the cold pressor task in pediatric pain research: A systematic review of methods. *The Journal of Pain, 13*(9), 817-826. doi:10.1016/j.jpain.2012.06.005
- Blount, R. L., Bunke, V., Cohen, L. L., & Forbes, C. J. (2001). The child--adult medical procedure interaction scale-short form (CAMPIS-SF): Validation of a rating scale for children's and adults' behaviors during painful medical procedures. *Journal of Pain and Symptom Management, 22*(1), 591-599. doi:10.1016/s0885-3924(01)00303-7
- Blount, R. L., Cohen, L. L., Frank, N. C., Bachanas, P. J., Smith, A. J., Manimala, M. R., et al. (1997). The child-adult medical procedure interaction scale-revised: An assessment of validity. *Journal of Pediatric Psychology, 22*(1), 73-88. doi:10.1093/jpepsy/22.1.73
- Blount, R. L., Corbin, S. M., Sturges, J. W., Wolfe, V. V., Prater, J. M., & James, L. D. (1989). The relationship between adults' behavior and child coping and distress during BMA/LP procedures: A sequential analysis. *Behavior Therapy, 20*(4), 585-601. doi:10.1016/s0005-7894(89)80136-4
- Boerner, K. E., Birnie, K. A., Caes, L., Schinkel, M., & Chambers, C. T. (2014). Sex differences in experimental pain among healthy children: A systematic review and meta-analysis. *Pain, 155*(5), 983-993. doi:10.1016/j.pain.2014.01.031
- Boerner, K. E., Chambers, C. T., Craig, K. D., Pillai Riddell, R. R., & Parker, J. A. (2013). Caregiver accuracy in detecting deception in facial expressions of pain in children. *Pain, 154*(4), 525-533. doi:10.1016/j.pain.2012.12.015
- Boerner, K. E., Noel, M., Birnie, K. A., Caes, L., Petter, M., & Chambers, C. T. (2015). Impact of threat level, task instruction, and individual characteristics on cold pressor pain and fear among children and their parents. *Pain Practice*. Advance online access. doi:10.1111/papr.12306
- Bögels, S. M. & Brechman-Toussaint, M. L. (2006). Family issues in child anxiety: Attachment, family functioning, parental rearing and beliefs. *Clinical Psychology Review, 26*(7), 834-856. doi:10.1016/j.cpr.2005.08.001

- Brennan, F., Carr, D. B., & Cousins, M. (2007). Pain management: A fundamental human right. *Anesthesia & Analgesia*, *105*(1), 205-221. doi:10.1213/01.ane.0000268145.52345.55
- Caes, L. (2014). An overview of how pediatric pain research has grown since 1975. *Pain Research and Management*, *19*(3), e31.
- Caes, L., Goubert, L., Devos, P., Verlooy, J., Benoit, Y., & Vervoort, T. (2014). The relationship between parental catastrophizing about child pain and distress in response to medical procedures in the context of childhood cancer treatment: A longitudinal analysis. *Journal of Pediatric Psychology*, *39*(7), 677-686. doi:10.1093/jpepsy/jsu034
- Caes, L., Goubert, L., Sullivan, M. J., & Chambers, C. T. (2013). Catastrophic thinking about pain: A critical appraisal highlighting the importance of the social context and balance. *Journal of Symptoms and Signs*, *2*(5), 298-308.
- Caes, L., Vervoort, T., Devos, P., Verlooy, J., Benoit, Y., & Goubert, L. (2014). Parental distress and catastrophic thoughts about child pain: Implications for parental protective behavior in the context of child leukemia-related medical procedures. *The Clinical Journal of Pain*, *30*(9), 787-799. doi:10.1097/ajp.0000000000000028
- Caes, L., Vervoort, T., Eccleston, C., & Goubert, L. (2012). Parents who catastrophize about their child's pain prioritize attempts to control pain. *Pain*, *153*(8), 1695-1701. doi:10.1016/j.pain.2012.04.028
- Caes, L., Vervoort, T., Eccleston, C., Vandenhende, M., & Goubert, L. (2011). Parental catastrophizing about child's pain and its relationship with activity restriction: The mediating role of parental distress. *Pain*, *152*(1), 212-222. doi:10.1016/j.pain.2010.10.037
- Caes, L., Vervoort, T., Trost, Z., & Goubert, L. (2012). Impact of parental catastrophizing and contextual threat on parents' emotional and behavioral responses to their child's pain. *Pain*, *153*(3), 687-695. doi:10.1016/j.pain.2011.12.007
- Campbell, C. M., Kronfli, T., Buenaver, L. F., Smith, M. T., Berna, C., Haythornthwaite, J. A., et al. (2010). Situational versus dispositional measurement of catastrophizing: Associations with pain responses in multiple samples. *The Journal of Pain*, *11*(5), 443-453.e2. doi:10.1016/j.jpain.2009.08.009
- Chambers, C. T., Craig, K. D., & Bennett, S. M. (2002). The impact of maternal behavior on children's pain experiences: An experimental analysis. *Journal of Pediatric Psychology*, *27*(3), 293-301. doi:10.1093/jpepsy/27.3.293

- Chambers, C. T., Giesbrecht, K., Craig, K. D., Bennett, S. M., & Huntsman, E. (1999). A comparison of faces scales for the measurement of pediatric pain: Children's and parents' ratings. *Pain, 83*(1), 25-35. doi:10.1016/s0304-3959(99)00086-x
- Chambers, C. T., Reid, G. J., Craig, K. D., McGrath, P. J., & Finley, G. A. (1998). Agreement between child and parent reports of pain. *The Clinical Journal of Pain, 14*(4), 336-342. doi:10.1097/00002508-199812000-00011
- Chorney, J. M., Garcia, A. M., Berlin, K. S., Bakeman, R., & Kain, Z. N. (2010). Time-window sequential analysis: An introduction for pediatric psychologists. *Journal of Pediatric Psychology, 35*(10), 1061-1070. doi:10.1093/jpepsy/jsq022
- Chorney, J. M., McMurtry, C. M., Chambers, C. T., & Bakeman, R. (2015). Developing and modifying behavioral coding schemes in pediatric psychology: A practical guide. *Journal of Pediatric Psychology, 40*(1), 154-164. doi:10.1093/jpepsy/jsu099
- Chung, M. L., Moser, D. K., Lennie, T. A., & Rayens, M. K. (2009). The effects of depressive symptoms and anxiety on quality of life in patients with heart failure and their spouses: Testing dyadic dynamics using actor-partner interdependence model. *Journal of Psychosomatic Research, 67*(1), 29-35. doi:10.1016/j.jpsychores.2009.01.009
- Cline, R. J., Harper, F. W., Penner, L. A., Peterson, A. M., Taub, J. W., & Albrecht, T. L. (2006). Parent communication and child pain and distress during painful pediatric cancer treatments. *Social Science & Medicine, 63*(4), 883-898. doi:10.1016/j.socscimed.2006.03.007
- Cohen, L. L., Manimala, R., & Blount, R. L. (2000). Easier said than done: What parents say they do and what they do during children's immunizations. *Children's Health Care, 29*(2), 79-86. doi:10.1207/s15326888chc2902_1
- Collins, W. A. & Russell, G. (1991). Mother-child and father-child relationships in middle childhood and adolescence: A developmental analysis. *Developmental Review, 11*(2), 99-136. doi:10.1016/0273-2297(91)90004-8
- Cook, W. L. (2001). Interpersonal influence in family systems: A social relations model analysis. *Child Development, 72*(4), 1179-1197. doi:10.1111/1467-8624.00341
- Cook, W. & Kenny, D. (2005). The actor-partner interdependence model: A model of bidirectional effects in developmental studies. *International Journal of Behavioral Development, 29*(2), 101-109. doi:10.1080/01650250444000405
- Craig, K. D. (2009). The social communication model of pain. *Canadian Psychology, 50*(1), 22-32. doi:10.1037/a0014772

- Craig, K. D., Versloot, J., Goubert, L., Vervoort, T., & Crombez, G. (2010). Perceiving pain in others: Automatic and controlled mechanisms. *The Journal of Pain, 11*(2), 101-108. doi:10.1016/j.jpain.2009.08.008
- Creamer, M., Foran, J., & Bell, R. (1995). The beck anxiety inventory in a non-clinical sample. *Behaviour Research and Therapy, 33*(4), 477-485. doi:10.1016/0005-7967(94)00082-u
- Crombez, G., Bijttebier, P., Eccleston, C., Mascagni, T., Mertens, G., Goubert, L., et al. (2003). The child version of the pain catastrophizing scale (PCS-C): A preliminary validation. *Pain, 104*(3), 639-646. doi:10.1016/s0304-3959(03)00121-0
- Cunningham, N. R., Lynch-Jordan, A., Barnett, K., Peugh, J., Sil, S., Goldschneider, K., et al. (2014). Child pain catastrophizing mediates the relation between parent responses to pain and disability in youth with functional abdominal pain. *Journal of Pediatric Gastroenterology and Nutrition, 59*(6), 732-738. doi:10.1097/mpg.0000000000000529
- Dahlquist, L. M., Power, T. G., & Carlson, L. (1995). Physician and parent behavior during invasive pediatric cancer procedures: Relationships to child behavioral distress. *Journal of Pediatric Psychology, 20*(4), 477-490. doi:10.1093/jpepsy/20.4.477
- Dahlquist, L. M., Power, T. G., Cox, C. N., & Fernbach, D. J. (1994). Parenting and child distress during cancer procedures: A multidimensional assessment. *Children's Health Care, 23*(3), 149-166. doi:10.1207/s15326888chc2303_1
- Dahlquist, L. M., & Pendley, J. S. (2005). When distraction fails: Parental anxiety and children's responses to distraction during cancer procedures. *Journal of Pediatric Psychology, 30*(7), 623-8. doi:10.1093/jpepsy/jsi048
- DeBoard-Lucas, R. L., Fosco, G. M., Raynor, S. R., & Grych, J. H. (2010). Interparental conflict in context: Exploring relations between parenting processes and children's conflict appraisals. *Journal of Clinical Child and Adolescent Psychology, 39*(2), 163-175. doi:10.1080/15374410903532593
- DeLambo, . E., Ievers-Landis, . E., Drotar, D., & Quittner, . L. (2004). Association of observed family relationship quality and problem-solving skills with treatment adherence in older children and adolescents with cystic fibrosis. *Journal of Pediatric Psychology, 29*(5), 343-353. doi:10.1093/jpepsy/jsh038
- Donenberg, G. R. & Weisz, J. R. (1997). Experimental task and speaker effects on parent-child interactions of aggressive and depressed/anxious children. *Journal of Abnormal Child Psychology, 25*(5), 367-387.

- Driscoll, K. A., Schatschneider, C., McGinnity, K., & Modi, A. C. (2012). Application of dyadic data analysis in pediatric psychology: Cystic fibrosis health-related quality of life and anxiety in child-caregiver dyads. *Journal of Pediatric Psychology*, 37(6), 605-611. doi:10.1093/jpepsy/jss063
- Eccleston, C. & Crombez, G. (1999). Pain demands attention: A cognitive-affective model of the interruptive function of pain. *Psychological Bulletin*, 125(3), 356. doi:10.1037//0033-2909.125.3.356
- Edens, J.L. & Gil, K.M. (1995). Experimental induction of pain: Utility in the study of clinical pain. *Behavior Therapy*, 26(2), 197-216.
- Esteve, R., Marquina-Aponte, V., & Ramírez-Maestre, C. (2014). Postoperative pain in children: Association between anxiety sensitivity, pain catastrophizing, and female caregivers' responses to children's pain. *The Journal of Pain*, 15(2), 157-168.e1. doi:10.1016/j.jpain.2013.10.007
- Evans, S., Keenan, T. R., & Shipton, E. A. (2007). Psychosocial adjustment and physical health of children living with maternal chronic pain. *Journal of Paediatrics and Child Health*, 43(4), 262-270. doi:10.1111/j.1440-1754.2007.01057.x
- Evans, S., Shipton, E. A., & Keenan, T. (2006). The relationship between maternal chronic pain and child adjustment: The role of parenting as a mediator. *The Journal of Pain*, 7(4), 236-243. doi:10.1016/j.jpain.2005.10.010
- Evans, S., Tsao, J. C., Lu, Q., Myers, C., Suresh, J., & Zeltzer, L. K. (2008). Parent-child pain relationships from a psychosocial perspective: A review of the literature. *Journal of Pain Management*, 1(3), 237-246.
- Fales, J. L., Essner, B. S., Harris, M. A., & Palermo, T. M. (2014). When helping hurts: Miscarried helping in families of youth with chronic pain. *Journal of Pediatric Psychology*, 39(4), 427-437. doi:10.1093/jpepsy/jsu003
- Feuerstein, M., Barr, R. G., Francoeur, T. E., Houle, M., & Rafman, S. (1982). Potential biobehavioral mechanisms of recurrent abdominal pain in children. *Pain*, 13(3), 287-298. doi:10.1016/0304-3959(82)90018-5
- Fisher, E., Caes, L., Clinch, J., Tobias, J. H., & Eccleston, C. (2015). Anxiety at 13 and its effect on pain, pain-related anxiety, and pain-related disability at 17: An ALSPAC cohort longitudinal analysis. *Psychology, Health & Medicine*. Advance online access. doi:10.1080/13548506.2015.1051062
- Fleiss, J. L., Levin, B., & Cho Paik, M. (2003). *Statistical methods for rates and proportions* (3rd ed.). New York, NY: John Wiley & Sons, Inc.
- Gauntlett-Gilbert, J. & Eccleston, C. (2007). Disability in adolescents with chronic pain: Patterns and predictors across different domains of functioning. *Pain*, 131(1-2), 132-141. hdoi:10.1016/j.pain.2006.12.021

- Gauthier, N., Thibault, P., & Sullivan, M. J. (2011). Catastrophizers with chronic pain display more pain behaviour when in a relationship with a low catastrophizing spouse. *Pain Research & Management, 16*(5), 293-299.
- Ghasemi, A. & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-statisticians. *International Journal of Endocrinology and Metabolism, 10*(2), 486-489. doi:10.5812/ijem.3505
- Ginsburg, G. S., Siqueland, L., Masia-Warner, C., & Hedtke, K. A. (2004). Anxiety disorders in children: Family matters. *Cognitive and Behavioral Practice, 11*(1), 28-43. doi:10.1016/s1077-7229(04)80005-1
- Goodman, J. E. & McGrath, P. J. (2003). Mothers' modeling influences children's pain during a cold pressor task. *Pain, 104*(3), 559-565. doi:10.1016/s0304-3959(03)00090-3
- Gormsen, L., Rosenberg, R., Bach, F. W., & Jensen, T. S. (2010). Depression, anxiety, health-related quality of life and pain in patients with chronic fibromyalgia and neuropathic pain. *European Journal of Pain, 14*(2), 127.e1-8. doi:10.1016/j.ejpain.2009.03.010
- Goubert, L. & Simons, L. E. (2014). Cognitive styles and processes in paediatric pain. In P. J. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), *Oxford textbook of paediatric pain*. (pp. 95-101). Oxford, United Kingdom: Oxford University Press.
- Goubert, L., Craig, K. D., Vervoort, T., Morley, S., Sullivan, M. J., de C Williams, A. C., et al. (2005). Facing others in pain: The effects of empathy. *Pain, 118*(3), 285-288. doi:10.1016/j.pain.2005.10.025
- Goubert, L., Eccleston, C., Vervoort, T., Jordan, A., & Crombez, G. (2006). Parental catastrophizing about their child's pain. The parent version of the pain catastrophizing scale (PCS-P): A preliminary validation. *Pain, 123*(3), 254-263. doi:10.1016/j.pain.2006.02.035
- Goubert, L., Vervoort, T., Cano, A., & Crombez, G. (2009). Catastrophizing about their children's pain is related to higher parent-child congruency in pain ratings: An experimental investigation. *European Journal of Pain, 13*(2), 196-201. doi:10.1016/j.ejpain.2008.03.009
- Goubert, L., Vervoort, T., De Ruddere, L., & Crombez, G. (2012). The impact of parental gender, catastrophizing and situational threat upon parental behaviour to child pain: A vignette study. *European Journal of Pain, 16*(8), 1176-1184. doi:10.1002/j.1532-2149.2012.00116.x
- Goubert, L., Vervoort, T., Sullivan, M. J., Verhoeven, K., & Crombez, G. (2008). Parental emotional responses to their child's pain: The role of dispositional empathy and catastrophizing about their child's pain. *The Journal of Pain, 9*(3), 272-279. doi:10.1016/j.jpain.2007.11.006

- Goubert, L., Vlaeyen, J. W., Crombez, G., & Craig, K. D. (2011). Learning about pain from others: An observational learning account. *The Journal of Pain, 12*(2), 167-174. doi:10.1016/j.jpain.2010.10.001
- Grunau, R. (2014). Long-term effects of pain in children. In P. J. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), *Oxford textbook of paediatric pain*. (pp. 30-38). Oxford, United Kingdom: Oxford University Press.
- Guite, J. W., Logan, D. E., McCue, R., Sherry, D. D., & Rose, J. B. (2009). Parental beliefs and worries regarding adolescent chronic pain. *The Clinical Journal of Pain, 25*(3), 223-232. doi:10.1097/ajp.0b013e31818a7467
- Guite, J. W., McCue, R. L., Sherker, J. L., Sherry, D. D., & Rose, J. B. (2011). Relationships among pain, protective parental responses, and disability for adolescents with chronic musculoskeletal pain: The mediating role of pain catastrophizing. *The Clinical Journal of Pain, 27*(9), 775-781. doi:10.1016/j.jpain.2009.01.251
- Hadjistavropoulos, T. & Craig, K. D. (2002). A theoretical framework for understanding self-report and observational measures of pain: A communications model. *Behaviour Research and Therapy, 40*(5), 551-570. doi:10.1016/s0005-7967(01)00072-9
- Hadjistavropoulos, T., Craig, K. D., Duck, S., Cano, A., Goubert, L., Jackson, P. L., et al. (2011). A biopsychosocial formulation of pain communication. *Psychological Bulletin, 137*(6), 910-939. doi:10.1037/a0023876
- Hale, W. W., Raaijmakers, Q., Muris, P., & Meeus, W. I. M. (2005). Psychometric properties of the screen for child anxiety related emotional disorders (SCARED) in the general adolescent population. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*(3), 283-290. doi:10.1097/00004583-200503000-00013
- Hechler, T., Vervoort, T., Hamann, M., Tietze, A. L., Vocks, S., Goubert, L., et al. (2011). Parental catastrophizing about their child's chronic pain: Are mothers and fathers different? *European Journal of Pain, 15*(5), 515.e1-9. doi:10.1016/j.ejpain.2010.09.015
- Hermann, C., Hohmeister, J., Zohsel, K., Tuttas, M. L., & Flor, H. (2008). The impact of chronic pain in children and adolescents: Development and initial validation of a child and parent version of the pain experience questionnaire. *Pain, 135*(3), 251-61. doi:10.1016/j.pain.2007.06.002
- Hicks, C. L., von Baeyer, C. L., Spafford, P. A., van Korlaar, I., & Goodenough, B. (2001). The faces pain scale-revised: Toward a common metric in pediatric pain measurement. *Pain, 93*(2), 173-183. doi:10.1016/s0304-3959(01)00314-1

- Higgins, K. S., Birnie, K.A., Chambers, C. T., Wilson, A. C., Caes, L., Clark, A. J., et al. (2015). Offspring of parents with chronic pain: A systematic review and meta-analysis of pain, health, psychological, and family outcomes. *Pain*. Advance online access. doi:10.1097/j.pain.0000000000000293
- Hoftun, G. B., Romundstad, P. R., & Rygg, M. (2013). Association of parental chronic pain with chronic pain in the adolescent and young adult: Family linkage data from the HUNT study. *JAMA Pediatrics*, *167*(1), 61-69. doi:10.1001/jamapediatrics.2013.422
- Holmbeck, G. N. (2002). Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *Journal of Pediatric Psychology*, *27*(1), 87-96. doi:10.1093/jpepsy/27.1.87
- Holmbeck, G. N., Li, S. T., Schurman, J. V., Friedman, D., & Coakley, R. M. (2002). Collecting and managing multisource and multimethod data in studies of pediatric populations. *Journal of Pediatric Psychology*, *27*(1), 5-18. doi:10.1093/jpepsy/27.1.5
- Hunfeld, J.A.M., Perquin, C.W., Duivenvoorden, H.J., Hazebroek-Kampschreur, A.A.J.M., Passchier, J., et al. (2001). Chronic pain and its impact on quality of life in adolescents and their families. *Journal of Pediatric Psychology*, *26*(3), 145-153. doi:10.1093/jpepsy/26.3.145
- Jastrowski Mano, K. E., Khan, K. A., Ladwig, R. J., & Weisman, S. J. (2011). The impact of pediatric chronic pain on parents' health-related quality of life and family functioning: Reliability and validity of the pedsql 4.0 family impact module. *Journal of Pediatric Psychology*, *36*(5), 517-527. doi:10.1093/jpepsy/jsp099
- Kashikar-Zuck, S., Sil, S., Lynch-Jordan, A. M., Ting, T. V., Peugh, J., Schikler, K. N., et al. (2013). Changes in pain coping, catastrophizing, and coping efficacy after cognitive-behavioral therapy in children and adolescents with juvenile fibromyalgia. *The Journal of Pain*, *14*(5), 492-501. doi:10.1016/j.jpain.2012.12.019
- Kazak, A. E., Simms, S., & Rourke, M. T. (2002). Family systems practice in pediatric psychology. *Journal of Pediatric Psychology*, *27*(2), 133-143. doi:10.1093/jpepsy/27.2.133
- Kenny, D. A. (2011). Commentary: Dyadic analyses of family data. *Journal of Pediatric Psychology*, *36*(5), 630-633. doi:10.1093/jpepsy/jsq124
- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: The Guilford Press.
- Kerig, P.K. & Lindahl, K.M. (Eds.). (2001) *Family Observational Coding Systems: Resources for Systemic Research*. Mahwah, NJ: Lawrence Erlbaum Associates.

- King, S., Chambers, C. T., Huguet, A., MacNevin, R. C., McGrath, P. J., Parker, L., et al. (2011). The epidemiology of chronic pain in children and adolescents revisited: A systematic review. *Pain, 152*(12), 2729-2738. doi:10.1016/j.pain.2011.07.016
- Kitzmann, K. M. (2000). Effects of marital conflict on subsequent triadic family interactions and parenting. *Developmental Psychology, 36*(1), 3-13. doi:10.1037//0012-1649.36.1.3
- Kliewer, W., Fearnow, M. D., & Miller, P. A. (1996). Coping socialization in middle childhood: Tests of maternal and paternal influences. *Child Development, 67*(5), 2339-2357. doi:10.2307/1131627
- Kliewer, W., Sandler, I., & Wolchik, S. (1994). Family socialization of threat appraisal and coping: Coaching, modeling, and family context. *Social Networks and Social Support in Childhood and Adolescence, 16*, 279-291. doi:10.1515/9783110866377.271
- Kristiansen, F. L., Olesen, A. E., Brock, C., Gazerani, P., Petrini, L., Mogil, J. S., & Drewes, A. M. (2014). The role of pain catastrophizing in experimental pain perception. *Pain Practice : The Official Journal of World Institute of Pain, 14*(3), E136-45. doi:10.1111/papr.1215
- Langer, S. L., Romano, J. M., Mancl, L., & Levy, R. L. (2014). Parental catastrophizing partially mediates the association between parent-reported child pain behavior and parental protective responses. *Pain Research and Treatment, 2014*, 1-9. doi:10.1155/2014/751097
- Larochette, A. C., Chambers, C. T., & Craig, K. D. (2006). Genuine, suppressed and faked facial expressions of pain in children. *Pain, 126*(1-3), 64-71. doi:10.1016/j.pain.2006.06.013
- Ledermann, T. & Kenny, D. A. (2012). The common fate model for dyadic data: Variations of a theoretically important but underutilized model. *Journal of Family Psychology, 26*(1), 140-148. doi:10.1037/a0026624
- Leve, L. D., & Fagot, B. I. (1997). Gender-role socialization and discipline processes in one-and two-parent families. *Sex Roles, 36*(1-2), 1-21. doi:10.1007/bf02766236
- Levy, R. L., Langer, S. L., Romano, J. M., Labus, J., Walker, L. S., Murphy, T. B., et al. (2014). Cognitive mediators of treatment outcomes in pediatric functional abdominal pain. *The Clinical Journal of Pain, 30*(12), 1033-1043. doi:10.1097/ajp.0000000000000077
- Lewandowski, A. S. & Palermo, T. M. (2009). Parent-teen interactions as predictors of depressive symptoms in adolescents with headache. *Journal of Clinical Psychology in Medical Settings, 16*(4), 331-338. doi:10.1007/s10880-009-9173-8

- Lewandowski, A. S., Palermo, T. M., Stinson, J., Handley, S., & Chambers, C. T. (2010). Systematic review of family functioning in families of children and adolescents with chronic pain. *The Journal of Pain, 11*(11), 1027-1038. doi:10.1016/j.jpain.2010.04.005
- Lindahl, K. M. (1998). Family process variables and children's disruptive behavior problems. *Journal of Family Psychology, 12*(3), 420-436. doi:10.1037/0893-3200.12.3.420
- Lindahl, K. M. & Malik, N. M. (1999). Marital conflict, family processes, and boys' externalizing behavior in hispanic american and european american families. *Journal of Clinical Child Psychology, 28*(1), 12-24. doi:10.1207/s15374424jccp2801_2
- Lindahl, K. M. & Malik, N. M. (2000). *System for coding interactions and family functioning (SCIFF): A coding system for family problem discussions*. Coral Gables, FL: University of Miami.
- Lindahl, K. M. & Malik, N. M. (2001). The system for coding interactions and family functioning. In P. K. Kerig & K. M. Lindahl (Eds.), *Family observational coding systems: Resources for systematic research*. (pp. 77-91). Mahwah, NJ: Lawrence Erlbaum Associates.
- Link, C. J. & Fortier, M. A. (2015). The relationship between parent trait anxiety and parent-reported pain, solicitous behaviors, and quality of life impairment in children with cancer. *Journal of Pediatric Hematology/Oncology*. Advance online access. doi:10.1097/mp.0000000000000376
- Little, R. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*(404), 1198-1202. doi:10.1080/01621459.1988.10478722
- Logan, D. E. & Scharff, L. (2005). Relationships between family and parent characteristics and functional abilities in children with recurrent pain syndromes: An investigation of moderating effects on the pathway from pain to disability. *Journal of Pediatric Psychology, 30*(8), 698-707. doi:10.1093/jpepsy/jsj060
- Logan, D. E., Guite, J. W., Sherry, D. D., & Rose, J. B. (2006). Adolescent-parent relationships in the context of adolescent chronic pain conditions. *The Clinical Journal of Pain, 22*(6), 576-583. doi:10.1097/01.ajp.0000210900.83096.ca
- Logan, D. E., Simons, L. E., & Carpino, E. A. (2012). Too sick for school? Parent influences on school functioning among children with chronic pain. *Pain, 153*(2), 437-443. doi:10.1016/j.pain.2011.11.004
- Lunkenheimer, E. S. & Leerkes, E. M. (2015). Innovative methods in the science of parent-child relations. *Infant and Child Development, 24*(3), 215-219. doi:10.1002/icd.1920

- Lynch-Jordan, A. M., Kashikar-Zuck, S., & Goldschneider, K. R. (2010). Parent perceptions of adolescent pain expression: The adolescent pain behavior questionnaire. *Pain, 151*(3), 834-842. doi:10.1016/j.pain.2010.09.025
- Lynch-Jordan, A. M., Kashikar-Zuck, S., Szabova, A., & Goldschneider, K. R. (2013). The interplay of parent and adolescent catastrophizing and its impact on adolescents' pain, functioning, and pain behavior. *The Clinical Journal of Pain, 29*(8), 681-688. doi:10.1097/ajp.0b013e3182757720
- Lyons, R. F., Mickelson, K. D., Sullivan, J. L., & Coyne, J. C. (1998). Coping as communal process. *Journal of Social and Personal Relationships, 15*(5), 579-605. doi:10.1177/0265407598155001
- Lytton, H., & Romney, D. M. (1991). Parents' differential socialization of boys and girls: A meta-analysis. *Psychological Bulletin, 109*(2), 267-296. doi:10.1037//0033-2909.109.2.267
- McGoldrick, M., Carter, B. A., & Garcia Preto, N.A. (Eds.) (2011). *The Expanded Family Life Cycle: Individual, Family, and Social Perspectives* (4th ed.). Needham Heights, MA: Allyn & Bacon.
- Martin, S. R., Chorney, J. M., Cohen, L. L., & Kain, Z. N. (2013). Sequential analysis of mothers' and fathers' reassurance and children's postoperative distress. *Journal of Pediatric Psychology, 38*(10), 1121-1129. doi:10.1093/jpepsy/jst061
- McGrath, P. J. (2011). Science is not enough: The modern history of pediatric pain. *Pain, 152*(11), 2457-2459. doi:10.1016/j.pain.2011.07.018
- McGrath, P. J., Walco, G. A., Turk, D. C., Dworkin, R. H., Brown, M. T., Davidson, K., et al. (2008). Core outcome domains and measures for pediatric acute and chronic/recurrent pain clinical trials: PedIMMPACT recommendations. *The Journal of Pain, 9*(9), 771-783. doi:10.1016/j.jpain.2008.04.007
- McLeod, B. D., Wood, J. J., & Weisz, J. R. (2007). Examining the association between parenting and childhood anxiety: A meta-analysis. *Clinical Psychology Review, 27*(2), 155-172. doi:10.1016/j.cpr.2006.09.002
- McMurtry, C. M., Chambers, C. T., McGrath, P. J., & Asp, E. (2010). When "don't worry" communicates fear: Children's perceptions of parental reassurance and distraction during a painful medical procedure. *Pain, 150*(1), 52-58. doi:10.1016/j.pain.2010.02.021
- Merskey, H. & Bogduk, N. (1994). *Classification of chronic pain, IASP task force on taxonomy*. Seattle, WA: International Association for the Study of Pain Press.
- Mitchell, S. K. (1979). Interobserver agreement, reliability, and generalizability of data collected in observational studies. *Psychological Bulletin, 86*(2), 376-390.

- Mogil, J. S. (2015). Social modulation of and by pain in humans and rodents. *Pain, 156 Suppl 1*, S35-41. doi:10.1097/01.j.pain.0000460341.62094.77
- Monga, S., Birmaher, B., Chiappetta, L., Brent, D., Kaufman, J., Bridge, J., et al. (2000). Screen for child anxiety-related emotional disorders (SCARED): Convergent and divergent validity. *Depression and Anxiety, 12*(2), 85-91. doi:10.1002/1520-6394(2000)12:2<85::aid-da4>3.0.co;2-2
- Moon, E. C., Chambers, C. T., & McGrath, P. J. (2011). "He says, she says": A comparison of fathers' and mothers' verbal behavior during child cold pressor pain. *The Journal of Pain, 12*(11), 1174-1181. doi:10.1016/j.jpain.2011.06.004
- Moon, E. C., Chambers, C. T., Larochette, A. C., Hayton, K., Craig, K. D., & McGrath, P. J. (2008). Sex differences in parent and child pain ratings during an experimental child pain task. *Pain Research & Management, 13*(3), 225-230.
- Murray, C. B., Amaro, C. M., Devine, K. A., Psihogios, A. M., Murphy, L. K., & Holmbeck, G. N. (2015). Observed macro- and micro-level parenting behaviors during preadolescent family interactions as predictors of adjustment in emerging adults with and without spina bifida. *Journal of Pediatric Psychology, 40*(1), 18-32. doi:10.1093/jpepsy/jsu030
- Noel, M., Rabbitts, J. A., Tai, G. G., & Palermo, T. M. (2015). Remembering pain after surgery: A longitudinal examination of the role of pain catastrophizing in children's and parents' recall. *Pain, 156*(5), 800-808. doi:10.1097/j.pain.000000000000102
- Osborne, R. B., Hatcher, J. W., & Richtsmeier, A. J. (1989). The role of social modeling in unexplained pediatric pain. *Journal of Pediatric Psychology, 14*(1), 43-61. doi:10.1093/jpepsy/14.1.43
- Pagé, M. G., Campbell, F., Isaac, L., Stinson, J., Martin-Pichora, A. L., & Katz, J. (2011). Reliability and validity of the child pain anxiety symptoms scale (CPASS) in a clinical sample of children and adolescents with acute postsurgical pain. *Pain, 152*(9), 1958-1965. doi:10.1016/j.pain.2011.02.053
- Pagé, M. G., Huguet, A., & Katz, J. (2014). Prevention of the development and maintenance of paediatric chronic pain and disability . In P. J. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), *Oxford textbook of paediatric pain*. (pp. 39-49). Oxford, United Kingdom: Oxford University Press.
- Pagé, M. G., Katz, J., Stinson, J., Isaac, L., Martin-Pichora, A. L., & Campbell, F. (2012). Validation of the numerical rating scale for pain intensity and unpleasantness in pediatric acute postoperative pain: Sensitivity to change over time. *The Journal of Pain, 13*(4), 359-369. doi:10.1016/j.jpain.2011.12.010
- Paikoff, R. L. & Brooks-Gunn, J. (1991). Do parent-child relationships change during puberty? *Psychological Bulletin, 110*(1), 47-66. doi:10.1037//0033-2909.110.1.47

- Palermo, T. M. & Chambers, C. T. (2005). Parent and family factors in pediatric chronic pain and disability: An integrative approach. *Pain, 119*(1-3), 1-4. doi:10.1016/j.pain.2005.10.027
- Palermo, T. M., Law, E. F., Essner, B., Jessen-Fiddick, T., & Eccleston, C. (2014). Adaptation of problem-solving skills training (PSST) for parent caregivers of youth with chronic pain. *Clinical Practice in Pediatric Psychology, 2*(3), 212-223. doi:10.1037/cpp0000067
- Palermo, T. M., Valrie, C. R., & Karlson, C. W. (2014). Family and parent influences on pediatric chronic pain: A developmental perspective. *The American Psychologist, 69*(2), 142-152. doi:10.1037/a0035216
- Parkerson, H. A., Noel, M., Pagé, M. G., Fuss, S., Katz, J., & Asmundson, G. J. (2013). Factorial validity of the english-language version of the pain catastrophizing scale--child version. *The Journal of Pain, 14*(11), 1383-1389. doi:10.1016/j.jpain.2013.06.004
- Pate, J. T., Blount, R. L., Cohen, L. L., & Smith, A. J. (1996). Childhood medical experience and temperament as predictors of adult functioning in medical situations. *Children's Health Care, 25*(4), 281-298. doi:10.1207/s15326888chc2504_4
- Petter, M., McGrath, P. J., Chambers, C. T., & Dick, B. D. (2014). The effects of mindful attention and state mindfulness on acute experimental pain among adolescents. *Journal of Pediatric Psychology, 39*(5), 521-531. doi:10.1093/jpepsy/jsu007
- Pielech, M., Ryan, M., Logan, D., Kaczynski, K., White, M. T., & Simons, L. E. (2014). Pain catastrophizing in children with chronic pain and their parents: Proposed clinical reference points and reexamination of the pain catastrophizing scale measure. *Pain, 155*(11), 2360-2367. doi:10.1016/j.pain.2014.08.035
- Pinquart, M. (2014). Associations of general parenting and parent-child relationship with pediatric obesity: A meta-analysis. *Journal of Pediatric Psychology, 39*(4), 381-393. doi:10.1093/jpepsy/jst144
- Power, T. G. (2004). Stress and coping in childhood: The parents' role. *Parenting: Science and Practice, 4*(4), 271-317. doi:10.1207/s15327922par0404_1
- Prins, B., Decuyper, A., & Van Damme, S. (2014). Effects of mindfulness and distraction on pain depend upon individual differences in pain catastrophizing: An experimental study. *European Journal of Pain, 18*(9), 1307-1315. doi:10.1002/j.1532-2149.2014.491.x
- Quartana, P. J., Campbell, C. M., & Edwards, R. R. (2009). Pain catastrophizing: A critical review. *Expert Review of Neurotherapeutics, 9*(5), 745-758. doi:10.1586/ern.09.34

- Reid, G. J., Gilbert, C. A., & McGrath, P. J. (1998). The pain coping questionnaire: Preliminary validation. *Pain, 76*(1), 83-96. doi:10.1016/s0304-3959(98)00029-3
- Reid, G. J., McGrath, P. J., & Lang, B. A. (2005). Parent-child interactions among children with juvenile fibromyalgia, arthritis, and healthy controls. *Pain, 113*(1-2), 201-210. doi:10.1016/j.pain.2004.10.018
- Robin, A. L. & Foster, S. L. (1989). *Negotiating parent-adolescent conflict: A behavioral-family systems approach*. New York, NY: Guilford Press.
- Rodriguez, E. M., Dunn, M. J., Zuckerman, T., Hughart, L., Vannatta, K., Gerhardt, C. A., et al. (2013). Mother-child communication and maternal depressive symptoms in families of children with cancer: Integrating macro and micro levels of analysis. *Journal of Pediatric Psychology, 38*(7), 732-743. doi:10.1093/jpepsy/jst018
- Ross, C. K., Lavigne, J. V., Hayford, J. R., Berry, S. L., Sinacore, J. M., & Pachman, L. M. (1993). Psychological factors affecting reported pain in juvenile rheumatoid arthritis. *Journal of Pediatric Psychology, 18*(5), 561-73.
- Schanberg, L. E., Keefe, F. J., Lefebvre, J. C., Kredich, D. W., & Gil, K. M. (1998). Social context of pain in children with juvenile primary fibromyalgia syndrome: Parental pain history and family environment. *The Clinical Journal of Pain, 14*(2), 107-115. doi:10.1097/00002508-199806000-00004
- Scharff, L., Langan, N., Rotter, N., Scott-Sutherland, J., Schenck, C., Taylor, N., et al. (2005). Psychological, behavioral, and family characteristics of pediatric patients with chronic pain: A 1-year retrospective study and cluster analysis. *The Clinical Journal of Pain, 21*(5), 432-438. doi:10.1097/01.ajp.0000130160.40974.f5
- Schechter, N. L. (1989). The undertreatment of pain in children: An overview. *Pediatric Clinics of North America, 36*(4), 781-794.
- Schechter, N. L., Finley, G. A., Bright, N. S., Laycock, M., & Forgeron, P. (2010). ChildKind: A global initiative to reduce pain in children. *Pediatric Pain Letter, 12*(3), 26-30.
- Severeijns, R., Vlaeyen, J. W., & van den Hout, M. A. (2004). Do we need a communal coping model of pain catastrophizing? An alternative explanation. *Pain, 111*(3), 226-229. doi:10.1016/j.pain.2004.07.024
- Shrout, P. E. & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86*(2), 420-428. doi:10.1037/0033-2909.86.2.420

- Sieberg, C. B., Flannery-Schroeder, E., & Plante, W. (2011). Children with co-morbid recurrent abdominal pain and anxiety disorders: Results from a multiple-baseline intervention study. *Journal of Child Health Care, 15*(2), 126-139. doi:10.1177/1367493511401640
- Simons, L. E., Smith, A., Kaczynski, K., & Basch, M. (2015). Living in fear of your child's pain: The parent fear of pain questionnaire. *Pain, 156*(4), 694-702. doi:10.1097/j.pain.0000000000000100
- Skinner, E. A. & Zimmer-Gembeck, M. J. (2007). The development of coping. *Annual Review of Psychology, 58*, 119-144.
- Skinner, H., Steinhauer, P., & Santa-Barbara, J. (1995). *Brief FAM: General scale*. Toronto, ON: Multi-Health Systems, Inc.
- Skinner, H., Steinhauer, P., & Sitarenios, G. (2000). Family assessment measure (FAM) and process model of family functioning. *Journal of Family Therapy, 22*(2), 190-210. doi:10.1111/1467-6427.00146
- Smith, K. B. & Chambers, C. T. (2006). Psychological and family functioning among children of parents with recurrent headaches. *The Journal of Pain, 7*(9), 635-643. doi:10.1016/j.jpain.2006.02.010
- Southall, D. P., Burr, S., Smith, R. D., Bull, D. N., Radford, A., Williams, A., et al. (2000). The child-friendly healthcare initiative (CFHI): Healthcare provision in accordance with the UN convention on the rights of the child. *Pediatrics, 106*(5), 1054-1064. doi:10.1542/peds.106.5.1054
- Spagrud, L. J., von Baeyer, C. L., Ali, K., Mpofo, C., Fennell, L. P., Friesen, K., et al. (2008). Pain, distress, and adult-child interaction during venipuncture in pediatric oncology: An examination of three types of venous access. *Journal of Pain and Symptom Management, 36*(2), 173-184. doi:10.1016/j.jpainsymman.2007.10.009
- Statistics Canada. (2013). *Nova Scotia (code 12) (table). National household survey (NHS profile). 2011 national household survey. Statistics Canada catalogue no. 99-004-XWE*. Ottawa. Retrived from <http://www12.statcan.gc.ca>
- Stevens, B. J., Abbott, L. K., Yamada, J., Harrison, D., Stinson, J., Taddio, A., et al. (2011). Epidemiology and management of painful procedures in children in canadian hospitals. *CMAJ, 183*(7), E403-10.
- Stevens, B.J. & Zempsky, W.T. (2014). Prevalence and distribution of pain in children. In P. J. McGrath, B. Stevens, S. Walker, & W. Zempsky (Eds.), *Oxford textbook of paediatric pain*. (pp. 12-19). Oxford, United Kingdom: Oxford University Press.

- Stinson, J. N., Kavanagh, T., Yamada, J., Gill, N., & Stevens, B. (2006). Systematic review of the psychometric properties, interpretability and feasibility of self-report pain intensity measures for use in clinical trials in children and adolescents. *Pain, 125*(1-2), 143-157. doi:10.1503/cmaj.101341
- Stora, B., Hagtvet, K. A., & Heyerdahl, S. (2013). Reliability of observers' subjective impressions of families: A generalizability theory approach. *Psychotherapy Research, 23*(4), 448-463. doi:10.1080/10503307.2012.733830
- Sturgeon, J. A. & Zautra, A. J. (2013a). Psychological resilience, pain catastrophizing, and positive emotions: Perspectives on comprehensive modeling of individual pain adaptation. *Current Pain and Headache Reports, 17*(3), 317-326. doi:10.1007/s11916-012-0317-4
- Sturgeon, J. A. & Zautra, A. J. (2013b). State and trait pain catastrophizing and emotional health in rheumatoid arthritis. *Annals of Behavioral Medicine, 45*(1), 69-77. doi:10.1007/s12160-012-9408-z
- Sullivan, M. J. (2012). The communal coping model of pain catastrophizing: Clinical and research implications. *Canadian Psychology, 53*(1), 32-41. doi:10.1037/a0026726
- Sullivan, M. J., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: Development and validation. *Psychological Assessment, 7*(4), 524-532. doi:10.1037//1040-3590.7.4.524
- Tabachnick, B. G. & Fidell, L. (2001). *Using multivariate statistics* (5th ed.). Toronto, ON: Pearson.
- Taylor, C., Sellick, K., & Greenwood, K. (2011). The influence of adult behaviors on child coping during venipuncture: A sequential analysis. *Research in Nursing & Health, 34*(2), 116-131. doi:10.1002/nur.20424
- Terry, E. L., Thompson, K. A., & Rhudy, J. L. (2015). Experimental reduction of pain catastrophizing modulates pain report but not spinal nociception as verified by mediation analyses. *Pain, 156*(8), 1477-1488. doi:10.1097/j.pain.000000000000192
- Thastum, M., Zachariae, R., Scheler, M., Bjerring, P., & Herlin, T. (1997). Cold pressor pain: Comparing responses of juvenile arthritis patients and their parents. *Scandinavian Journal of Rheumatology, 26*(4), 272-279. doi:10.3109/03009749709105316
- Treister, R., Nielsen, C. S., Stubhaug, A., Farrar, J. T., Pud, D., Sawilowsky, S., et al. (2015). Experimental comparison of parametric versus nonparametric analyses of data from the cold pressor test. *The Journal of Pain, 16*(6), 537-548. doi:10.1016/j.jpain.2015.03.001

- Tremblay, I. & Sullivan, M. J. (2010). Attachment and pain outcomes in adolescents: The mediating role of pain catastrophizing and anxiety. *The Journal of Pain, 11*(2), 160-171. doi:10.1016/j.jpain.2009.06.015
- Trost, Z., Strachan, E., Sullivan, M., Vervoort, T., Avery, A. R., & Afari, N. (2015). Heritability of pain catastrophizing and associations with experimental pain outcomes: A twin study. *Pain, 156*(3), 514-520. doi:10.1097/01.j.pain.0000460326.02891.fc
- Tsao, J.C.I., Glover, D.A., Bursch, B., Ifekwunigwe, M., & Zeltzer, L.K. (2002). Laboratory pain reactivity and gender: Relationship to school nurse visits and school absences. *Developmental and Behavioral Pediatrics, 23*(4), 217-224. doi:10.1097/00004703-200208000-00004
- Turk, D. C., Flor, H., & Rudy, T. E. (1987). Pain and families. I. Etiology, maintenance, and psychosocial impact. *Pain, 30*(1), 3-27. doi:10.1016/0304-3959(87)90080-7
- Uman, L. S., Birnie, K. A., Noel, M., Parker, J. A., Chambers, C. T., McGrath, P. J., et al. (2013). Psychological interventions for needle-related procedural pain and distress in children and adolescents. *Cochrane Database of Systematic Reviews (Online), 10*, CD005179.
- Umberger, W. (2014). Children of parents with chronic noncancer pain: A comprehensive review of the literature. *Journal of Child and Adolescent Psychiatric Nursing, 27*(1), 26-34. doi:10.1111/jcap.12055
- van der Bruggen, C. O., Bögels, S. M., & van Zeilst, N. (2010). What influences parental controlling behaviour? The role of parent and child trait anxiety. *Cognition & Emotion, 24*(1), 141-149. doi:10.1080/02699930802618843
- van der Bruggen, C. O., Stams, G. J., & Bögels, S. M. (2008). Research review: The relation between child and parent anxiety and parental control: A meta-analytic review. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 49*(12), 1257-1269. doi:10.1111/j.1469-7610.2008.01898.x
- van Dijk, A., McGrath, P., Pickett, W., & VanDenKerkhof, E. G. (2006). Pain prevalence in nine- to 13-year-old schoolchildren. *Pain Research & Management, 11*(4), 234-240.
- Verhoeven, K., Crombez, G., Eccleston, C., Van Ryckeghem, D. M., Morley, S., & Van Damme, S. (2010). The role of motivation in distracting attention away from pain: An experimental study. *Pain, 149*(2), 229-234. doi:10.1016/j.jpain.2010.01.019
- Verhoeven, K., Goubert, L., Jaaniste, T., Van Ryckeghem, D. M., & Crombez, G. (2012). Pain catastrophizing influences the use and the effectiveness of distraction in schoolchildren. *European Journal of Pain, 16*(2), 256-267. doi:10.1016/j.ejpain.2011.06.015

- Vervoort, T., Caes, L., Crombez, G., Koster, E., Van Damme, S., Dewitte, M., & Goubert, L. (2011). Parental catastrophizing about children's pain and selective attention to varying levels of facial expression of pain in children: A dot-probe study. *Pain, 152*(8), 1751-1757. doi:10.1016/j.pain.2011.03.015
- Vervoort, T., Caes, L., Trost, Z., Notebaert, L., & Goubert, L. (2012). Parental attention to their child's pain is modulated by threat-value of pain. *Health Psychology, 31*(5), 623-631. doi:10.1037/a0029292
- Vervoort, T., Caes, L., Trost, Z., Sullivan, M., Vangronsveld, K., & Goubert, L. (2011). Social modulation of facial pain display in high-catastrophizing children: An observational study in schoolchildren and their parents. *Pain, 152*(7), 1591-1599. doi:10.1016/j.pain.2011.02.048
- Vervoort, T., Craig, K. D., Goubert, L., Dehoorne, J., Joos, R., Matthys, D., et al. (2008). Expressive dimensions of pain catastrophizing: A comparative analysis of school children and children with clinical pain. *Pain, 134*(1-2), 59-68. doi:10.1016/j.pain.2007.03.038
- Vervoort, T., Eccleston, C., Goubert, L., Buysse, A., & Crombez, G. (2010). Children's catastrophic thinking about their pain predicts pain and disability 6 months later. *European Journal of Pain (London, England), 14*(1), 90-96. <http://dx.doi.org/10.1016/j.ejpain.2009.03.001>
- Vervoort, T., Goubert, L., & Crombez, G. (2009). The relationship between high catastrophizing children's facial display of pain and parental judgment of their child's pain. *Pain, 142*(1-2), 142-148. doi:10.1016/j.pain.2008.12.028
- Vervoort, T., Goubert, L., Eccleston, C., Vandenhende, M., Claeys, O., Clarke, J., et al. (2009). Expressive dimensions of pain catastrophizing: An observational study in adolescents with chronic pain. *Pain, 146*(1-2), 170-176. doi:10.1016/j.pain.2009.07.021
- Vervoort, T., Goubert, L., Vandenbossche, H., Van Aken, S., Matthys, D., & Crombez, G. (2011). Child's and parents' catastrophizing about pain is associated with procedural fear in children: A study in children with diabetes and their mothers. *Psychological Reports, 109*(3), 879-895. doi:10.2466/07.15.16.21.pr0.109.6.879-895
- Vervoort, T., Huguet, A., Verhoeven, K., & Goubert, L. (2011). Mothers' and fathers' responses to their child's pain moderate the relationship between the child's pain catastrophizing and disability. *Pain, 152*(4), 786-793. doi:10.1016/j.pain.2010.12.010
- Vervoort, T., Trost, Z., Sütterlin, S., Caes, L., & Moors, A. (2014). Emotion regulatory function of parent attention to child pain and associated implications for parental pain control behaviour. *Pain, 155*(8), 1453-1463. doi:10.1016/j.pain.2014.04.015

- Vervoort, T., Trost, Z., & Van Ryckeghem, D. M. (2013). Children's selective attention to pain and avoidance behaviour: The role of child and parental catastrophizing about pain. *Pain, 154*(10), 1979-1988. doi:10.1016/j.pain.2013.05.052
- von Baeyer, C. L., Marche, T. A., Rocha, E. M., & Salmon, K. (2004). Children's memory for pain: Overview and implications for practice. *The Journal of Pain, 5*(5), 241-249. doi:10.1016/j.jpain.2004.05.001
- von Baeyer, C. L., Piira, T., Chambers, C. T., Trapanotto, M., & Zeltzer, L. K. (2005). Guidelines for the cold pressor task as an experimental pain stimulus for use with children. *The Journal of Pain, 6*(4), 218-227. doi:10.1016/j.jpain.2005.01.349
- von Baeyer, C. L., Uman, L. S., Chambers, C. T., & Gouthro, A. (2011). Can we screen young children for their ability to provide accurate self-reports of pain? *Pain, 152*(6), 1327-1333. doi:10.1016/j.pain.2011.02.013
- Vowles, K. E., Cohen, L. L., McCracken, L. M., & Eccleston, C. (2010). Disentangling the complex relations among caregiver and adolescent responses to adolescent chronic pain. *Pain, 151*(3), 680-686. doi:10.1016/j.pain.2010.08.031
- Walker, L. S., Sherman, A. L., Bruehl, S., Garber, J., & Smith, C. A. (2012). Functional abdominal pain patient subtypes in childhood predict functional gastrointestinal disorders with chronic pain and psychiatric comorbidities in adolescence and adulthood. *Pain, 153*(9), 1798-1806. doi:10.1016/j.pain.2012.03.026
- Walker, L. S., Williams, S. E., Smith, C. A., Garber, J., Van Slyke, D. A., & Lipani, T. A. (2006). Parent attention versus distraction: Impact on symptom complaints by children with and without chronic functional abdominal pain. *Pain, 122*(1-2), 43-52. doi:10.1016/j.pain.2005.12.020
- Welkom, J. S., Hwang, W. T., & Guite, J. W. (2013). Adolescent pain catastrophizing mediates the relationship between protective parental responses to pain and disability over time. *Journal of Pediatric Psychology, 38*(5), 541-550. doi:10.1093/jpepsy/jst011
- Whisman, M. A. & McClelland, G. H. (2005). Designing, testing, and interpreting interactions and moderator effects in family research. *Journal of Family Psychology, 19*(1), 111-120. doi:10.1037/0893-3200.19.1.111
- Williams, S., Logan, D., Sieberg, C., & Simons, L. (2012). Parent/child catastrophizing matches and mismatches: The effect on pain, symptoms, and disability. *The Journal of Pain, 13*(4), S103. doi:10.1016/j.jpain.2012.01.426
- Williams, S. E., Blount, R. L., & Walker, L. S. (2011). Children's pain threat appraisal and catastrophizing moderate the impact of parent verbal behavior on children's symptom complaints. *Journal of Pediatric Psychology, 36*(1), 55-63. doi:10.1093/jpepsy/jsq043

- Williams, S. R., Kertz, S. J., Schrock, M. D., & Woodruff-Borden, J. (2012). A sequential analysis of parent-child interactions in anxious and nonanxious families. *Journal of Clinical Child and Adolescent Psychology, 41*(1), 64-74. doi:10.1080/15374416.2012.632347
- Wilson, A. C., Lewandowski Holley, A., & Palermo, T. M. (2013). Applications of laboratory pain methodologies in research with children and adolescents: Emerging research trends. *Pain, 154*(8), 1166-1169. doi:10.1016/j.pain.2013.04.014
- Wilson, A. C., Moss, A., Palermo, T. M., & Fales, J. L. (2014). Parent pain and catastrophizing are associated with pain, somatic symptoms, and pain-related disability among early adolescents. *Journal of Pediatric Psychology, 39*(4), 418-426. doi:10.1093/jpepsy/jst094
- Woodruff-Borden, J., Morrow, C., Bourland, S., & Cambron, S. (2002). The behavior of anxious parents: Examining mechanisms of transmission of anxiety from parent to child. *Journal of Clinical Child and Adolescent Psychology, 31*(3), 364-374. doi:10.1207/s15374424jccp3103_08
- World Health Organization (2012). *WHO Guidelines on the Pharmacological Treatment of Persisting Pain in Children with Medical Illnesses*. Geneva: World Health Organization.
- World Health Organization (2015). Meeting of the strategic advisory group of experts on immunization, april 2015: Conclusions and recommendations. *Weekly Epidemiological Record / Health Section of the Secretariat of the League of Nations, 90*(22), 261-278.
- Yoder, P. J. & Symons, F. J. (2010). *Observational measurement of behavior*. New York, NY: Springer Publishing Company.
- Zimmer-Gembeck, M. J. & Locke, E. M. (2007). The socialization of adolescent coping behaviours: Relationships with families and teachers. *Journal of Adolescence, 30*(1), 1-16. doi:10.1016/j.adolescence.2005.03.001