LONGITUDINAL ASSOCIATIONS BETWEEN CHILD AND PARENT HEALTH-RELATED QUALITY OF LIFE IN FAMILIES RECEIVING TREATMENT FOR PEDIATRIC CHRONIC PAIN

by

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ABSTRACT

LONGITUDINAL ASSOCIATIONS BETWEEN CHILD AND PARENT HEALTH-RELATED QUALITY OF LIFE IN FAMILIES RECEIVING TREATMENT FOR PEDIATRIC CHRONIC PAIN

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Pediatric chronic pain has been shown to be a relatively common condition with negative physical and psychological effects for the patient. In addition, parents and families with a child dealing with chronic pain are often also affected by the child's experiences of pain. Accordingly, several theoretical frameworks stipulate that a child's parents and family play a critical a role in how a child functions with chronic pain. While cognitive-behavioral therapies for children with chronic pain have been shown to be effective in reducing pain experiences, researchers have noted limitations in these treatment studies. Among the limitations are the lack of family integration into treatments, and data collection focusing on pain reduction as an outcome goal rather than improved child functioning. Given these limitations, the present study examined the longitudinal associations between parent and child health-related quality of life (HRQOL) in families seeking treatment for complex pediatric chronic pain. Families waiting for their intake appointment at an interdisciplinary chronic pain clinic were recruited to participate in a longitudinal study consisting of completing child and parent measures. Participants in the study were 192 families who had completed both child and mother measures at least two

of the three time waves (i.e., intake, 1-month, 3-months). Patients were predominantly White (86.1%), adolescent (71.9%), and female (73.9%). Results of the study indicate that initial (i.e., intake, 1-month) self-reports of parent HRQOL and family functioning are predictive of later (i.e., 1-month, 3-months) self-reports of child HRQOL, above and beyond demographic and pain characteristics. Therefore, the present study corroborates the theoretical importance of family variables in pediatric chronic pain, and has clinical implications for its treatment.

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Longitudinal associations between child and parent health-related quality of life in families receiving treatment for pediatric chronic pain

Pain has been defined as an unpleasant sensory and emotional experience that is a result of actual or perceived tissue damage (American Pain Society, 2001). The operational definition of pediatric chronic pain varies depending on the particular study, but most studies have delineated a minimum duration of 3 to 6 months of persistent pain as indicative of pain lasting beyond the normal time of healing (Dahlquist & Nagel, 2009). Notably, the term recurrent pain is sometimes used instead of chronic pain to describe pain that is more episodic than constant in nature (Dahlquist & Nagel, 2009), but the term chronic pain will be used in this paper to refer to both types of persistent pain. Epidemiological research has shown pediatric chronic pain to be a common experience, with studies across multiple nations reporting more than 25% of children and adolescents experiencing chronic pain (Zeltzer, Tsao, Bursch, & Myers, 2006). In one study of 715 German children and adolescents drawn from schools, researchers reported that 35.4% of their 10 to 18 years-old participants reported having pain for longer than 6 months (Roth-Isigkeit, Thyen, Raspe, Stoven, & Schumaker, 2005). In a larger study that attempted to recruit a representative Dutch sample of children age 0 to 18 years-old, researchers reported that 25% of their 5,423 subjects were reported to have pain for longer than 3 months (Perquin et al., 2000). Multiple studies have found that chronic pain is more common in adolescents and in females, with headaches, abdominal pain, limb pain, back pain, and juvenile fibromyalgia/fatigue being the most common pediatric pain conditions (Schecter, Berde, & Yaster, 2003; Roth et al., 2005; Perquin et al., 2000).

This study will examine the role of family in the treatment of pediatric chronic pain. To accomplish this, the biological basis of pain will first be discussed, followed by a review of the multiple negative effects chronic pain has on children. This will be followed by an evaluation of studies that have documented the impact of pediatric chronic pain and other chronic conditions on parents. Next, theoretical frameworks will be discussed that posit family variables as influential in the child's adjustment to chronic illness, along with studies that provide empirical support for family's influential role. The construct of health-related quality of life (HRQOL) will then be described as it has the potential to meaningfully reflect the effect of pediatric chronic pain on both patients and families. A brief review of the medical treatments for pediatric chronic pain will be followed by descriptions of the cognitive-behavioral techniques often used in the psychological treatment of children with chronic pain. The results of four meta-analyses of psychological treatments of pediatric chronic pain will be covered in detail, which will lead to a discussion of the limitations of treatment research in this field. Last, the present study will be described as it addresses two limitations of the current literature: the lack of family variables collected in treatment studies, and data collection focusing on pain reduction as an outcome goal rather than increased child functioning.

The present study is a longitudinal investigation into the associations between parent-reported family functioning, self-reported parent HRQOL, and self-reported child HRQOL amongst families receiving treatment at an interdisciplinary pediatric chronic pain clinic. Due to its focus on child, parent, and family functioning in families receiving care, the present study has clinical implications on the treatment of these distressed families.

Biological Bases of Pain

Pain can be categorized as being of two distinct biological etiologies: nociceptive and neuropathic (Scholz & Woolf, 2007). Nociceptive pain occurs when tissue is damaged, which results in the release of neurochemicals, such as serotonin, histamine and neuropeptides (Covington, 2000). These neurochemicals subsequently activate a variety of different nociceptors, with different nociceptors being associated with differing pain characteristics (i.e., sharp, dull, aching; Covington, 2000). In contrast, neuropathic pain is the result of increased sensitization of nerves in the peripheral or central nervous system, such that previously innocuous sensations would then produce painful sensations (Scholz & Woolf, 2007). Over time, neuropathic pain tends to become more severe as the repeated stimulations of the sensitized nerves results in lower pain thresholds, and pain may even be experienced without provocation (Zieglgansberger, Berthele, & Tolle, 2005). Both nociceptive and neuropathic pain can become chronic pain as both types can persist for a long period of time (Scholz & Woolf, 2007), consistent with the definition of chronic pain being longer in duration than the expected time of healing (American Pain Society, 2001).

Effects and Influences of Chronic Pain on Children

As noted by the American Pain Society (2001), the experience of pain is not just limited to the unpleasant physical sensation. In fact, researchers have found that pediatric chronic pain has multiple deleterious effects on children's school functioning, peer functioning, sleep quality, and emotional functioning (Palermo, 2000). For instance, Konijnenberg and colleagues (2005) reported that 51% of the 149 children with chronic pain surveyed reported significant absences from school as a result of their pain. In terms

of sleep, Long, Krishnamurthy, and Palermo (2008) reported that in cross-sectional study of 100 children with chronic pain, 53% of children were above the clinical cutoff for sleep disturbance. In addition, such sleep disturbance was associated with greater functional disability and lower HRQOL in the children. Last, in terms of emotional functioning, Fichtel and Larsson (2002) reported that the frequency of headaches was positively associated with more depressive and anxiety symptoms among the 793 Swedish adolescents assessed in their school-based study. This increase in depressive symptoms may be at least partly attributable to the loss of positive activities experienced by children with chronic pain (Lewandowski, Palermo, & Peterson, 2006). In addition, the pain-related disability experienced by children with chronic pain may be exacerbated by avoidance of activities due to the fear of incurring pain (Martin, McGrath, Brown, & Katz, 2007). In fact, researchers have reported that these passive coping strategies (i.e., behavioral disengagement, isolation, denial) are associated with greater functional disability, more depressive symptoms, increased somatic symptoms, and higher levels of pain among adolescents dealing with chronic pain (Compas et al., 2006).

Recently, there has been some research that has examined how parental responses to pain can influence the child's experience and management of chronic pain (Palermo & Chambers, 2005; Welkom, Hwang, & Guite, 2013). Specifically, parental encouragement and modeling of adaptive and maladaptive coping strategies may inadvertently reinforce pain-related behaviors and lead to reduced functioning in the child (Palermo, 2000; Compas et al., 2006; Walker, Smith, Garber, & Claar, 2005). An example of maladaptive coping is pain catastrophizing where the individual ruminates, magnifies, and believes they are helpless in managing their pain (Crombez et al., 2003).

A set of parental responses that may inadvertently reinforce pain catastrophizing and impair children's functioning is protective parenting responses (Claar, Simons, & Logan, 2008; Simons, Claar, & Logan, 2008; Sieberg, Williams, & Simons, 2011), which include giving the child additional attention and limiting the child's normal activities and responsibilities (Claar, Guite, Kaczynski, & Logan, 2010). For example, Welkom, Hwang, and Guite (2013) conducted a longitudinal study at a tertiary chronic pain clinic of 121 adolescents and their parents to examine the relationships between pain catastrophizing, protective parental responses, and children's functioning. Researchers reported that while all three constructs were related to each other, adolescent self-reported pain catastrophizing mediated the relationship between protective parental responses and child functioning at intake and two months later. Specifically, greater frequency in parental protective responses was associated with stronger pain catastrophizing beliefs, and this latter variable was associated with reduced functioning. Additionally, a decrease in parent-reported parent protective responses was associated with lower levels of pain catastrophizing and subsequently, to increased child functioning from intake to two-month follow-up (Welkom et al., 2013).

Chronic pain can have such a deleterious global effect on children that researchers have recently described this wide-ranging effect as pain-associated disability syndrome (PADS; Zeltzer, Tsao, Bursch, & Myers, 2006). PADS is the deterioration of the child's functioning in at least two areas (e.g., school, physical, emotional) as a result of chronic pain (Bursch, Joseph, & Zeltzer, 2003). While researchers believe this situation is likely to occur when contextual and contributing factors, like parenting and environmental

variables, are not addressed in treatment (Bursch et al., 2003), PADS needs to be better defined to be reliably assessed and diagnosed (Zeltzer et al., 2006).

The negative effects of pediatric chronic pain appear to be not just limited to childhood. Fearon and Hotopf (2001) conducted a national cohort study in Great Britain of 98% of births from March 3rd to 9th, 1958. Of the 17,414 original participants, researchers were able to gather data from 69% of them 33 years later. Researchers reported that children who reported having frequent headaches were prospectively 2.20 times at greater risk to report frequent headaches as adults, 1.75 times at greater risk to report multiple negative physical symptoms as adults, and 1.41 times at greater risk to report psychiatric symptoms as adults (Fearon & Hotopf, 2001). As the authors noted, the study "…confirms that children with headache do not simply 'grow out' of their somatic complaints and may also 'grow into' others" (Fearon & Hotopf, 2001, p. 3).

Effects of Pediatric Chronic Pain on Parents

Pediatric chronic pain does not just affect the patients, but their parents as well. Due to limited research on families dealing with pediatric chronic pain, research that has been conducted in other pediatric chronic conditions is helpful to consider. Research has shown that pediatric chronic conditions create chronic stress for both children and parents, which influence the psychological well-being of both child and parents (Palermo & Eccleston, 2009; Kazak, Rourke, & Navsaria, 2009; Robinson, Gerhardt, Vannatta, & Noll, 2007; Friedman, Holmbeck, Jandasek, Zukerman, & Abad, 2004). Specifically regarding chronic pain, researchers reported that adolescents' higher levels of pain and lower levels of quality of life were associated with parental distress and limited social life in a 3 week study of 128 adolescents and their mothers (Hunfeld et al., 2001).

Multiple studies have shown that the chronic health problem of a child not only increases the parenting responsibilities on one or both parents, but also may add marital conflict in the parents' attempts to negotiate these increased responsibilities and stress (Pelchat, Lefebvre, & Levert, 2007). Among these stressors are the high number of medical visits and subsequent economic costs associated with the medical care of a child with chronic illness (Palermo, 2000; Bennett, Huntsman, & Lilley, 2000). While previous cross-sectional studies had shown that parents with a child with a chronic health condition experience more depressive symptoms and martial dissatisfaction than parents of a healthy child, Berge, Patterson, and Rueter (2006) conducted a 5-year longitudinal study of 173 children with a chronic illness and their parents. The authors reported that the mothers' marital satisfaction was influenced by their perception of child's condition, and the child's severity of condition led to relative decreases in marital satisfaction and increases in depressive symptoms. In contrast, only the fathers' previous self reports of depressive symptoms and marital satisfaction influenced relative decreases in marital satisfaction and relative increases in depressive symptoms (Berge, Patterson, & Rueter, 2006). Therefore, it is important for researchers to examine both mothers' and fathers' experiences as they may differ.

Notably, most of the research on parents with a chronic health condition has been conducted with only mothers, and this has been cited as a weakness of pediatric psychology research (Seagull, 2000; Phares, Lopez, Fields, Kamboukos, & Duhig, 2005). Drawing from research done on various pediatric health condition populations, it is clear that fathers are also significantly affected by their child's health (Goble, 2004). For example, in a qualitative analysis of semi-structured interviews with 22 fathers of

children with juvenile rheumatoid arthritis, McNeill (2004) reported the fathers were profoundly affected by their child's health, and were prone to rely on themselves exclusively in an effort to provide emotional support to their family. Similarly, 16 fathers of children with cancer were interviewed in the same fashion, and the authors reported that these fathers experienced isolation, sadness, and uncertainty over their family's future (Nicholas, et al., 2009). Additionally, Katz and Krulik (1999) reported that fathers of children with chronic illness indicated having more stressful life events and lower self-esteem than fathers of relatively healthy children.

While both mothers and fathers are affected by their child's health, the coping strategies utilized by fathers appear to be different than those used by mothers (Pelchat, Lefebvre, & Levert, 2007). For example, mothers have been found to express their emotions regarding their child's health, while fathers are more apt to utilize cognitive problem-solving strategies (Pelchat et al., 2007). In addition to different coping strategies, mothers and fathers may report differently on how the family is functioning. In a study of 53 children with diabetes, Auslander, Bubb, Rogge, and Santiago (1993) reported that the fathers' reports of family stress and resources, and not the mothers' reports, were significantly associated with metabolic control. The authors speculated that the fathers' reports of family functioning may be more accurate as they are typically not as involved in the daily management of diabetes, and therefore may be less invested than mothers in depicting the family in an overly favorable fashion (Auslander et al., 1993). Given these findings, inclusion of both mothers and fathers in the study of families dealing with pediatric chronic pain is needed for optimal understanding.

Theoretical Frameworks

While fathers have often not been included in pediatric psychology research, there are at least four frameworks that posit familial variables as important determinants of children's psychological adjustment to chronic illness. These include the Family adjustment and adaptation response (FAAR) model (McCubbin & Patterson, 1982), the Risk and Resistance model (Wallander, Varni, Babani, Banis, & Wilcox, 1989), the Family Systems model (Minuchin et al., 1975; Minuchin, Rosman, & Baker, 1978), and the Integrate Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability (Palermo & Chambers, 2005). While these four frameworks differ in their theoretical underpinnings and specific hypotheses, all four emphasize the importance of including family variables in the study of pediatric chronic pain. Since the Integrative Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability guided the present study, this framework will be described in detail.

In their framework, Palermo and Chambers (2005) specifically theorize how families with children with chronic pain function. The authors describe their framework as integrative as it combines aspects of both family systems and operant theories. The framework stipulates that relationships between family level variables and chronic pain/functional disability are reciprocal, and that child's gender, emotional symptoms, age/developmental status, coping, and parent's own pain history are proposed to be moderating factors in these relationships. For example, the authors note that the child's level of autonomy may be something that becomes more important to assess as the child becomes an adolescent. Family level variables (e.g., family environment, overall functioning) subsume dyadic variables (e.g., parent-child interactions), which subsume

individual variables (e.g., parenting style, parental reinforcement/solicitousness). In addition, the framework integrates behavioral theories of parenting behavior at each of these levels, such as solicitous responses from parents reinforcing children's pain-related behavior. This framework aims to promote the study of reciprocal relationships between chronic pain and family variables, and for researchers to collect data from multiple family members to better understand the family context.

Logan and Scharff (2005) conducted a study consistent with this framework of 73 children with either migraines or recurrent abdominal pain who completed questionnaires, along with their mothers and fathers. The authors reported three main findings. First, maternal reports of family environment and parental distress jointly predicted children's ability to maintain functionality despite pain, after controlling for the children's pain intensity. In addition, maternal reports of family environment moderated the relationship between pain and functional disability among children with migraines. Lastly, among children with migraines who had disruptive family environments, greater pain was associated with more functional disability, but greater pain was not associated with more functional disability in children from more adaptive family environments (Logan & Scharff, 2005). In sum, family environment and parental distress were found to be predictive of child functioning, despite level of pain, thus supporting the multi-level relationships proposed by Palermo and Chambers (2005).

Health-Related Quality of Life (HRQOL)

As has been discussed, research into the effects of chronic pain on patients, parents, and families has included numerous constructs due to its wide-ranging effects. This use of disparate constructs (e.g., depressive symptoms, parental distress, days

missed from school) can be viewed as a weakness of the field as these constructs may not capture the myriad effects that pediatric chronic pain has on children and families, as they are not necessarily designed to do so. Additionally, measures should be ideally tailored to the contexts of individual chronic illnesses as different chronic illnesses may affect the child and family differently (Quittner, 2000). Therefore, the use of outcome variables such as number of depressive symptoms and days missed from school, while informative, do not provide an appropriate assessment of the level of functioning of the child or family.

A construct that is increasingly being used to assess the impact of chronic illness is HRQOL. While a universal definition of HRQOL does not exist, there is a general consensus that HRQOL is a subjective measure of one's level of functioning as it relates to one's health, across multiple domains (i.e., physical, emotional, social; Kamphuis et al., 2002). Put more simply, HRQOL can be defined as the satisfaction felt by an individual as it pertains to his/her health (Vila et al., 2003). Measuring the child's or parents' perception of child's HRQOL gives clinicians and researchers alike a quantitative, singular, and comprehensive outcome measure of how large an impact the chronic pain is having on the child over several domains (Trautmann, Lackschewitz, & Kroner-Herwig, 2006). Since HRQOL is a multidimensional construct, it may offer a more comprehensive assessment of functioning than measures of functional disability and physical functioning, (e.g., Functional Disability Inventory; Walker & Greene, 1991; Child Activity Limitations Interview; Palermo, Witherspoon, Valenzuela, & Drotar, 2004; Child Activity Limitations Questionnaire; Hainsworth, Davies, Khan, & Weisman, 2007) as such measures do not assess how the child functions socially and academically.

A commonly used measure of child's HRQOL is the Pediatric Quality of Life Inventory (PedsQL™; Varni, Seid, & Rode, 1999). The measure consists of a 15-item core measure of global HRQOL and eight supplemental modules assessing specific symptoms or treatment domains. The measure can be completed as a child self-report or as a parent-proxy of the child's HRQOL. The global HRQOL is given as a number from 0 to 100, with higher scores indicating better HRQOL. Results from multiple studies have shown the PedsQL™ to be a reliable and valid measure of children's HRQOL from ages 5 to 18, across healthy and chronically ill children and in hospital and school settings (e.g., Varni, Seid, & Rode, 1999; Varni, Seid, & Kurtin, 2001; Varni, Burwinkle, Seid, & Skarr, 2003; Varni, Burwinkle, & Seid, 2006). In addition, in a literature review of children's HRQOL, Varni, Limbers, and Burwinkle (2007) conclude that child self-reported HRQOL should be collected whenever the patient is willing and able to provide their perspective as their report may be a more accurate reflection of their HRQOL than their parents' reports. The authors note that parent-proxy reports were found to only explain 10-25% of the variance in child self-report HRQOL, and argued that children as young as five years-old are accurate self-reporters.

Notably, the PedsQL™ 4.0 generic core scales were administered to 332 treatment-seeking children with chronic pain and their parents (Jastrowski Mano, Khan, Ladwig, & Weisman, 2011). Compared to an oncology sample of 389 children (Varni, Limbers, & Burwinkle, 2007), children and their parents dealing with pediatric chronic pain reported total HRQOL scores about one standard deviation lower than children and parents dealing with pediatric cancer (Jastrowski et al., 2011). This comparison of HRQOL illustrates how severely chronic pain can affect children's lives.

Since pediatric chronic pain and other pediatric chronic conditions have been shown to have deleterious effects on both children and their parents (Palermo, 2000; Palermo & Chambers, 2005; Wallander & Varni, 1992; Bennett, Hunstman, & Lilley, 2000), a measure that captures how the parents are affected from this stress is valuable. One such measure is the PedsQL^{TM} Family Impact Module (FIM), which gives a quantitative indicator of the parent's self-reported HRQOL and family functioning as a result of their child's health (Varni, Sherman, Burwinkle, Dickinson, & Dixon, 2004). The FIM consists of 36 items across the following eight domains: physical functioning, emotional functioning, social functioning, cognitive functioning, communication, worry, daily activities, and family relationships. Due to these multiple domains, the authors argue the FIM is better able to capture the myriad ways a parent can be affected from having a child with a chronic illness (Varni, et al., 2004). This is in contrast to the few other similar measures that tend to be one-dimensional and limited in scope (e.g., Impact on Family Scale-Revised; Stein & Jessup, 2003; Child Health Questionnaire; Landgraf, Abetz, & Ware, 1996). For example, the majority of the items on the Impact on Family Scale deal with how family events and life are affected by the child's chronic illness, but do not specify how the parents are affected by the child's illness (Stein & Jessop, 2003). Similarly, the Family Environment Scale assesses multiple aspects of family functioning, but not specifically as a result of children's health (Moos & Moos, 1994).

Since the FIM is a relatively new measure (Varni et al., 2004), there have only been a few studies that have looked into its psychometric properties. Nonetheless, the FIM has demonstrated reliability and validity with families in the following samples: medically fragile children (Varni et al., 2004), cancer (Scarpelli, Paiva, Pordeus, Varni,

Viegas, & Allison, 2008), inflammatory bowel disease (Kunz, Greenley, & Howard, 2011), child recipients of kidney transplants (Anthony et al., 2010), attention-deficit hyperactivity disorder (Limbers, Ripperger-Suhler, Boutton, Ransom, & Varni, 2011), community sample (Medrano, Berlin, & Davies, 2013), and chronic pain (Jastrowski Mano, Khan, Ladwig, & Weisman, 2011). However, researchers have reported large ceiling effects, poor discriminant validity and limited predictive validity when the FIM was administered to families with and without sickle cell disease (Panepinto, Hoffman, & Pajewski, 2009), and families with a child with developmental delays (Hsieh, Huang, Lin, Wu, & Lee, 2008). Clearly, more validation research needs to be conducted on these and other illness groups to reconcile these apparently discrepant results.

In the study validating the use of the FIM in families dealing with pediatric chronic pain (Jastrowski Mano et al., 2011), researchers reported that the measure demonstrated excellent internal consistency and concurrent validity with validated measures of pain catastrophizing, functional disability, children's HRQOL and child emotional and behavioral problems. Therefore, the authors deemed the FIM as an appropriate measure of parental HRQOL and family functioning for families dealing with pediatric chronic pain. These results not only support the reliability and validity of the measure, but also provide support for the proposed multi-level relationships between child functioning, parent functioning, and family functioning (Palermo & Chambers, 2005). In addition, Jastrowski Mano and colleagues (2011) note that the parents of children with chronic pain reported lower parental HRQOL and family functioning than the parents of medically fragile children from the initial validation study (Varni et al.,

2004); which once again underscores how severely pediatric chronic pain impacts children and their families.

Treatments for Pediatric Chronic Pain

As the experience of chronic pain is not simply limited to the unpleasant physical sensations, clinicians are urged to conceptualize and treat chronic pain in the biopsychosocial model instead of the mind-body dualism model (American Pain Society, 2001). The biopsychosocial model stipulates that "medical" conditions, including chronic pain, are created and maintained by the constant confluence of biological, psychological and social variables (Zeltzer, Tsao, Bursch, & Myers, 2006). This is in contrast to the mind-body dualism view that maintains medical and psychological conditions as separate and distinct (American Pain Society, 2001). The fact that pain intensity variables alone give an incomplete assessment and inconsistent predictor of child and family functioning (Palermo, 2000) is viewed as supporting the biopsychosocial model (Zeltzer, Tsao, Bursch, & Myers, 2006). The treatment of pediatric chronic pain with medical interventions alone is viewed as incomplete (Bursch, Joseph, & Zeltzer, 2003) and potentially harmful for children with chronic pain (Masters, 2006). As a result, treatments of chronic pain include pharmacological, physical, and psychological interventions (Dahlquist & Nagel, 2009). Comprehensive treatments that include all of these interventions in a multidisciplinary setting are highly recommended for the treatment of complex pediatric chronic pain (American Pain Society, 2001; Bursch, Joseph, & Zeltzer, 2003).

Among the pharmacological interventions available for the treatment of pediatric chronic pain are nonsteroidal anti-inflammatory drugs (i.e., aspirin, ibuprofen),

acetaminophen, narcotics (i.e., codeine, morphine) and tricyclic antidepressants (Dahlquist & Nagel, 2009). Notably, many of the current pharmacological strategies that are used in treating children with pediatric chronic pain are taken from adult research, so more clinical trials with children are warranted (American Pain Society, 2001). Physical interventions, such as transcutaneous electrical nerve stimulation (TENS) therapy, physical therapy, occupational therapy and biofeedback, have also been shown effective in reducing pain, but primarily with adults as well (Dahlquist & Nagel, 2009).

Among the psychological interventions used for the treatment of pediatric chronic pain, treatment packages utilizing cognitive-behavioral techniques have been the most studied and tested (Palermo, Eccleston, Lewandowski, Williams, & Morley, 2010). In addition, in an earlier review of psychological treatments for recurrent abdominal pain, researchers reported that cognitive-behavioral treatments were the only treatment approach to meet criteria to be deemed as probably efficacious intervention (Janicke & Finney, 1999). Consequently, these interventions will be covered in this review. These omnibus cognitive-behavioral therapies usually include the following techniques: relaxation, imagery, challenging self-cognitions, and operant interventions (Dahlquist & Nagel, 2009).

The teaching of relaxation typically includes diaphragmatic breathing and progressive muscle relaxation (Larsson, Carlsson, Fichtel, & Melin, 2005). Diaphragmatic breathing consists of slowing the client's breathing rate while having them breath profoundly so as to activate their diaphragm. Progressive muscle relaxation teaches participants to tense and relax a series of specific groups of muscles. Eventually, participants are often taught to tense and relax their entire body. Imagery can be used to

enhance relaxation as participants are asked to imagine themselves in a setting that is either incompatible with pain, has not been associated with pain, or is a very pleasant situation for the participant (Robins, Smith, Glutting, & Bishop, 2005). The challenging of self-cognitions consists of the therapist targeting and challenging negative and catastrophizing thoughts of the client, and attempting to replace them with more encouraging and effective thoughts regarding pain and pain management (Dahlquist & Nagel, 2009). Lastly, operant interventions focus on decreasing a child's illness-related behaviors that are maintained by positive and negative reinforcement (Levy & Walker, 2005). For example, the avoidance of physical activity may result in short-term relief from pain, thus resulting in negative reinforcement. Unfortunately, such passive coping strategies have been found to increase pain and functional disability in the longer term (Compas et al., 2006), so this behavior could become a target behavior to change. In addition, parent behaviors can be targeted, such as providing comfort and allowing activity avoidance, which can unintentionally provide positive reinforcement to pain-related behaviors (Palermo & Chambers, 2005).

As cognitive-behavioral treatments are often delivered in package formats, with most of the aforementioned interventions interwoven in therapy, individual techniques have rarely been tested for their efficacy in treating pediatric chronic pain in isolation (Dahlquist & Nagel, 2009). Consequently, the essential components of treatment packages have not been identified through dismantling studies (Eccleston, Morley, Williams, Yorke, & Mastroyannopoulou, 2002). Notably, researchers have shown that the teaching of relaxation techniques at school for adolescents with tension headaches or migraines is effective in reducing the number of headaches and headache intensity, as

compared to attention control and self-monitoring conditions (Larsson, Carlsson, Fichtel, & Melin, 2005). The researchers also found that across the seven randomized clinical trials of 288 adolescents from which the results were obtained, treatment gains were maintained at the 6 and 10 month follow-up. Therefore, the authors concluded that teaching relaxation techniques is an effective treatment for adolescents with chronic headaches, although they noted that adolescents with migraines appeared to benefit only from therapist-administered relaxation and not school nurse administered relaxation (Larsson et al., 2005).

Analysis of psychological treatments.

In order to summarize results and trends from the many treatment studies that have been conducted on children with chronic pain, the results of four meta-analyses from the past 18 years will be discussed. Hermann, Kim and Blanchard (1995) conducted two meta-analyses that were meant to compare the effectiveness of behavioral interventions to pharmacological interventions in reducing migraine pain in children. The second meta-analysis included only studies that had a control condition to which participants could be randomly assigned to, which allowed researchers to compare the effects of the intervention to a control group. This type of research design, called randomized controlled trial (RCT), accounts for improvement due to mere passage of time or other non-specific variables not attributable to the active components of the treatment of interest (Kazdin, 2003). Due to the high internal validity of this research design, it is recognized as the most definitive study method in demonstrating that an intervention is effective (Kazdin, 2003).

In the first meta-analysis, the outcome data of the treatment conditions suggested that thermal biofeedback and biofeedback/progressive muscle relaxation combined treatments were more effective in reducing pain than other behavioral treatments, which were more effective than prophylactic drug treatments (Hermann, Kim, & Blanchard, 1995). The second meta-analysis failed to fully reproduce these results, largely due to the small number of studies that had a control condition. Nonetheless, all of the psychological treatments significantly reduced migraine pain as compared to the placebo and wait-list conditions. Notably, of the 17 behavioral and 24 drug interventions that were in the first meta-analysis, only nine behavioral and 11 drug interventions were included in the second meta-analysis as a result of insufficient data and study designs. Ultimately, the researchers concluded that definitive statements regarding the differential efficacy of these treatments could not be made due to the small number of studies, small sample sizes, and methodological limitations (Hermann, et al., 1995).

Eccleston and colleagues (2002) conducted a systematic review of 18 RCTs and a meta-analysis of 13 RCTs for the treatment of pediatric chronic pain. Of the 13 RCTs selected for meta-analysis, 12 were for headaches and one was for recurrent abdominal pain. Ten of these trials included cognitive-behavioral therapies, while the other treatment modalities were relaxation only and relaxation with biofeedback. The researchers reported that the treatments were significantly better than control treatments in reducing pain intensity, and therefore concluded that the reviewed cognitive-behavioral treatments were effective treatments in reducing pain (Eccleston et al., 2002). The authors noted though that although there is a lot of research to support the effectiveness of cognitive-behavioral treatments, research has not been done to identify

the essential components of these omnibus package treatments (Eccleston et al., 2002). While the psychological interventions were shown be effective in reducing pain, the authors noted many shortcomings of the 18 RCTs reviewed. These limitations included: lack of treatment adherence checks (only three of 18 RCTs had adherence checks), incomplete information regarding therapists (six of 18 RCTs reported no information), lack of information on medication use (four RCTs reported medication information) and details on how randomization was executed (all RCTs reported no information).

The authors also noted that outside of pain intensity and frequency, no other data was consistently collected across the 18 RCTs reviewed. For example, the authors noted that only eight of the RCTs collected outcome data on children's mood, which is something many families probably expect to be addressed in psychological treatment (Eccleston et al., 2002). Consequently, the authors stated, "There is insufficient evidence to judge the effectiveness of psychological therapies in improving mood, function, or disability associated with chronic pain in children and adolescents" (Eccleston et al., 2002, pg. 163). As a result, Eccleston and colleagues (2002) called for the use of a multidimensional variable to assess the impact chronic pain has on children and families, and for a greater focus on assessing for functioning in addition to pain intensity and frequency.

A similar meta-analysis was conducted by Trautmann, Lackschewitz, and Kroner-Herwig (2006) as they searched for RCTs for the treatment of pediatric chronic headaches from the years 1996 to 2004. After statistically controlling for publication bias in the 23 included RCTs (10 included cognitive-behavioral treatments), researchers reported that the psychological treatments were more effective in decreasing pain than

compared to the control groups. Additionally, analysis on the 16 RCTs with sufficient long-term data indicated that the effects of the psychological treatments lasted for at least one year (Trautmann et al., 2006). Notwithstanding these positive results, Trautmann and colleagues (2006) called for more active control groups (fourof 23 RCTs had them) to further bolster these results, along with more comparisons of psychological treatment to pharmacological treatments. In addition, the researchers noted that of the 23 RCTs, only nine RCTs had measurements of one or more of the following: disability, anxiety, quality of life, depression, coping, self-efficacy, or physiological measures. Therefore, the authors called for researchers to use measures of these constructs in their treatment studies in order to identify moderators and focus more on functioning. In fact, Trautmann and colleagues (2006) stated, "Quality of life could be the most comprehensive and meaningful index of improvement" (Trautmann et al., 2006, pg. 1423).

The most recent published meta-analysis of psychological treatments of pediatric chronic pain was conducted by Palermo, Eccleston, Lewandowski, Williams, and Morley (2010). This meta-analysis was designed as an update on Eccleston and colleagues' (2002) meta-analysis, so 14 of the 18 original RCTs were included in this update, along with 11 new RCTs. Of the 25 total RCTs, 12 were categorized as including cognitive-behavioral treatments, nine were categorized as including relaxation-based treatments, and four were categorized as including biofeedback treatments. Similar to previous meta-analyses, the authors reported that the psychological interventions were significantly more effective than the control conditions in reducing pain in children with headaches, abdominal pain, and fibromyalgia. In addition, the psychological treatments' effects were

found to be stable for at least three months. Due to the small number of RCTs, comparisons between treatment types were not possible.

Another aim of the study was to go beyond pain intensity and examine the psychological treatments' effects on emotional functioning and pain-related disability. Unfortunately, while all 25 RCTs had data on pain intensity, only six had data on emotional functioning and six had data on pain-related disability. The meta-analysis showed no significant difference between these psychological treatments and control conditions in improving either emotional functioning or pain-related disability (Palermo et al., 2010). In addition, follow up data on emotional functioning or disability was insufficient to support meta-analysis. As with the original meta-analysis, the authors made several suggestions for future RCT studies while noting an overall improvement in study quality over the past several years. These recommendations included: attention control conditions instead of wait-list control conditions, more intent-to-treat analyses to conservatively estimate condition effects, more information on individual child differences that may influence treatment response, higher number of participants, and assessment of more outcome variables. Specifically, the authors called for researchers to assess functioning, in addition to pain intensity, as a treatment outcome (Palermo et al., 2010).

Literature limitations.

Taken together, these meta-analyses show that psychological treatments, including cognitive-behavioral therapies, are effective in reducing pain intensity. Nonetheless, authors of these meta-analyses called for the use of stronger control conditions and larger participant samples, among other changes, to bolster these results.

Also noted by these reviews was the paucity of assessed outcome variables besides pain intensity (Palermo, 2009). Although Eccleston and colleagues (2002) called for researchers to focus more on functioning, eight years later, Palermo and colleagues (2010) were calling for the same change. This exclusive focus on reducing pain intensity is counter to numerous appeals from researchers (e.g., American Pain Society, 2001; Bursch, Joseph, & Zeltzer, 2003; Zeltzer, Tsao, Bursch, & Myers, 2006), who argue that the main goal of treating children with chronic pain is to increase their functioning, not reduce their pain. Unfortunately, according to the meta-analysis done by Palermo and colleagues (2010), our current psychological treatments appear not to achieve this primary goal.

The other major limitation of these treatments for children with chronic pain is the lack of family integration. Notably, none of the reviews raised this as a major concern. Of the 25 RCTs in Palermo and colleagues' (2010) meta-analysis, only two were categorized as family interventions (e.g., Sanders et al., 1989; Robins, Smith, Glutting, & Bishop, 2005). This lack of family involvement in treatment not only goes against theoretical frameworks that stipulate family members as influential in the development, maintenance or coping of chronic pain (e.g., McCubbin & Patterson, 1982; Wallander, Varni, Babanis, & Wilcox, 1989; Minuchin et al., 1975; Palermo & Chambers, 2005); but also goes counter to the empirical studies demonstrating that parent and family functioning affect child functioning (Palermo & Eccleston, 2009; Kazak, Rourke, & Navsaria, 2009; Logan & Scharff, 2005). Given that parental responses and beliefs regarding their child's chronic pain have been shown to affect the child's ability to cope with their pain (Simons, Claar, & Logan, 2008; Crushell et al., 2003; Welkom, Hwang, & Guite, 2013), the exclusion of

parents from treatment is a major limitation of the field. In addition, numerous studies have documented that parents of children with chronic pain are quite distressed (e.g., Jastrowski Mano, Khan, Ladwig, & Weisman, 2011; Hunfeld et al., 2001; Palermo, 2000) and warrant their own clinical attention (Palermo & Eccleston, 2009).

This lack of family integration into the treatment of pediatric chronic pain even includes an RCT that included the family. Robins, Smith, Glutting, and Bishop (2005) conducted an RCT in which 34 parent-child dyads received standard medical care (SMC) for the child's recurrent abdominal pain and 43 parent-child dyads received SMC and cognitive-behavioral therapy (SMC + CBT). SMC was left to the discretion of the treating gastroenterologist or primary care physician to tailor the medical treatment to the child. The cognitive behavioral therapy entailed five bimonthly sessions with a psychologist or pre-doctoral intern. The therapists met regularly with the principal investigator to ensure consistent implementation of the therapy protocol. The primary goals of the therapy were to teach the connection between stress and pain to children and parents, teach active coping skills to children (i.e., imagery, relaxation, self-statements), and to assist parents in developing adaptive responses to their child (i.e., from "protector" to "coach"). All parents and children completed measures prior to treatment, 3 months after study entry, and 6 to 12 months after study entry. Measures assessed pain variables (i.e., frequency, intensity, duration), child's somatization, and child's functional disability.

Robins and colleagues (2005) found that parent-child dyads who were in the SMC + CBT group reported significantly lower pain scores at the 3 month and 6 to 12 month follow-up times than parent-child dyads in the SMC group. These significant differences

were found after demographic variables were entered as covariates, and were present when researchers utilized intent-to-treat analyses to account for drop-outs. In addition, children in the SMC + CBT group were absent from school an average of six days fewer than children in the SMC group in the 12-months after the study began, and this difference was found to be statistically significant. On the other hand, researchers did not find significant differences between the SMC+ CBT and SMC group in terms of functional disability or somatization. Participants in both groups reported lower levels of somatization and functional disability post-intervention. Researchers noted that the study may have been underpowered to find significant differences in somatization, and that the scores on the functional disability measure were in a small, restricted range (Robins et al., 2005). While these statistical limitations are valid reasons for the lack of significant differences, the limited role that parents played in therapy is worth discussing.

Of the five sessions, parents were present for three of them (i.e., sessions #1, 4 and 5). Parents were included in these three sessions primarily to teach the pain and stress connection, and to teach them operant techniques to decrease their child's pain-related behavior (Robins et al., 2005). The authors did not report collecting any data on parent beliefs about pain, parent functioning, or on whether the operant techniques were effectively being utilized at home. The lack of such data is contrary to the theories (e.g., McCubbin & Patterson, 1982; Wallander, Varni, Babanis, & Wilcox, 1989; Minuchin et al., 1975; Palermo & Chambers, 2005) and empirical results (e.g., Kazak, Rourke, & Navsaria, 2009; Palermo & Eccleston, 2009; Logan & Scharff, 2005; Simons, Claar, & Logan, 2008; Crushell et al., 2003; Welkom, Hwang, & Guite, 2013) that strongly suggest that parents' beliefs, functioning, and responses to pain are influential in the

child's experience of pain. In addition, without such data, potential mechanisms of change that involve the family that may improve children's functioning cannot be identified(American Pain Society, 2001; Palermo, Eccleston, Lewandowski, Williams, & Morley, 2010). By not integrating the family more completely into treatment, researchers and clinicians may not be addressing the contextual factors that are hindering the improvement of children's functioning--the primary goal of therapy with chronic pain (Bursch, Joseph, & Zeltzer, 2003; Palermo & Eccleston, 2009; American Pain Society, 2001).

Study Aims

In an attempt to address these limitations in the literature, the present study examined how child functioning is associated with parent and family functioning over the course of treatment. Specifically, child self-report HRQOL, parent self-report parental HRQOL, and parent-reported family functioning were assessed in families receiving treatment for pediatric chronic pain three times in the 3 months following their intake appointment at the chronic pain clinic. The analysis of such family variables, along with the child's functioning, elucidate how the family context influences the child's functioning over the course of treatment for pediatric chronic pain. Such analysis is seen as the first step in analyzing how parent and family functioning influence the primary goal of treatment of pediatric chronic pain: child functioning. Additionally, the present study is seen as fitting within the Integrative Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability (Palermo & Chambers, 2005) as the family variables that were assessed in the study (i.e., parental HRQOL, family functioning) were examined as predictors of child functioning (i.e., child HRQOL) in

children dealing with chronic pain. Refer to Figure 1 to see how the present study's variables fit within this theoretical model. Due to this theoretical basis and the clinical setting of the study, this study has both theoretical and clinical implications.

In addition, by assessing parent, child, and family functioning multiple times early in the course of treatment (i.e., intake, 1-month, 3-months), this study may provide additional support for the importance of early treatment progress in both children and their parents. Bernacki and colleagues (2012) conducted a pilot study with 98 adolescents and their families receiving treatment for pediatric chronic pain from a multidisciplinary pain clinic to examine the influence that readiness to change (RTC) has on treatment outcomes. RTC can be defined as a client's preparedness and willingness to engage in behavioral change to achieve a treatment goal. This variable has been postulated as influential in a client's progress in psychotherapy for a wide-range of clinical problems (Prochaska & DiClemente, 1982), including pediatric chronic pain (Guite, Logan, Simons, Blood, & Kearns, 2011). Bernacki and colleagues (2012) reported that while RTC assessed at intake was not predictive of treatment outcomes 1 month later (e.g., pain intensity, HRQOL, functional disability, pain catastrophizing), changes in RTC from intake to 1-month were predictive of treatment outcomes. In other words, clients who were assessed by clinicians as progressing towards the Action and Maintenance stages from intake to 1-month were more likely to report improved treatment outcomes than clients who were assessed as remaining stable or regressing in terms of RTC. Therefore, the results of this pilot study suggest that changes in clients during the early course of treatment may be more predictive of outcomes than clients' initial presentation. By assessing family, parent, and child functioning thrice during the first 3 months of

treatment, the present study could elucidate the influence of early treatment progress on child functioning.

In light of these objectives, there were four primary aims to the study. One, to compare the child HRQOL, father HRQOL, mother HRQOL, father-reported family functioning, and mother-reported family functioning scores across the three time waves (e.g., intake, 1-month, 3-month) to assess if the level of individual and family functioning changed. Two, to examine if earlier family variables (i.e., parental HRQOL and family functioning) predict later child HRQOL, above and beyond demographic and pain characteristics. The third primary aim was to compare the predictive value of intake family variables to 1-month family variables in terms of predicting 3-month child HRQOL. Lastly, exploratory analyses were conducted with 1-year child HRQOL to examine if earlier family variables predict child functioning 1-year post intake.

Hypotheses

First, child HRQOL, parental HRQOL, and family functioning were expected to significantly improve over the course of 3 months after intake. Specifically, child and parental HRQOL and family functioning were expected to increase over 3 months.

Second, regression models with earlier family variables (i.e., parental HRQOL, family functioning) were expected to significantly predict later child HRQOL.

Third, 1-month family variables (i.e., parental HRQOL, family functioning) were expected to be more predictive of 3-month child HRQOL than the family variables at intake.

Methods

The present study was part of a larger, ongoing study at an interdisciplinary pain clinic in a large Midwestern pediatric hospital. The present and ongoing study have been approved by the Institutional Review Board of Children's Hospital of Wisconsin, and the present study was additionally approved by the Institutional Review Board of the University of Wisconsin-Milwaukee.

Participants

Participants involved in the ongoing study were families of treatment-seeking children and adolescents with chronic pain between the ages of 8 and 18 years at the interdisciplinary pain clinic. The sample was selected from parents of consecutive new patients who presented to an outpatient interdisciplinary pain clinic at a large Midwestern pediatric hospital between November 2009 and October 2012. All patients were referred by their primary care physician and/or by another pediatric subspecialist for further evaluation of their chronic pain condition. Families were included in the sample if the mother and the child completed and returned measures for at least two of three data collection waves. Exclusion criteria were history of significant developmental delay (as determined by clinic personnel) and non-English speaking family members.

Refer to Figure 2 for a depiction of the participant flow into the present study. Approximately 915 families came to the interdisciplinary pain clinic for an intake appointment, and approximately 300 families were missed for recruitment into the ongoing longitudinal study. Approximately 103 families were ineligible for the longitudinal study for a variety of reasons, including child age (47.6%), presence of developmental delays (15.5%), language (14.6%; i.e., measures only available in

English), and parent being unavailable for consent (8.7%). Consequently, of the approximate 515 families approached for recruitment into the longitudinal study, 455 families (88.3%) consented to participate. Fifty families withdrew from the longitudinal study for a variety of reasons, including wishing to cease receiving questionnaires and their child no longer being seen at the interdisciplinary chronic pain clinic. Of the 405 families that continued participation in the ongoing longitudinal study from November 2009 to October 2012, 192 families (47.4%) were included in the present study. The chief reason for exclusion from the present study was non-completion of 1-month and 3-month follow-up measures. For the purpose of exploratory analyses, data from these participants from their 1-year follow-up was also included.

Procedure

Families completed a series of questionnaires before their initial intake appointment at the interdisciplinary pain clinic as part of the standard clinical intake procedure. The three questionnaire packets (i.e., father, mother, and child reports) were mailed to families prior to their interdisciplinary pain clinic appointment. Parents and children were asked to complete the questionnaires individually and return them by the date of the evaluation. For the purposes of the present study, questionnaires related to parent HRQOL and children HRQOL were included.

While the families waited to be seen for their intake appointment in the lobby, they were approached by a research assistant to inquire if they were interested in participating in a longitudinal study. The longitudinal study consists of families receiving similar packets of questionnaires that they received prior to their intake at their home address at 1 month, 3 months and one year following their intake. To participate in this

voluntary study, families were asked to complete and return these measures to the pain clinic in the included pre-paid envelope.

To ensure families received the questionnaires and had any questions they had answered, three phone calls were made by a research assistant over the span of four weeks. Follow-up packets were mailed about a week prior to their 1-month, 3-month and 1-year follow-up times. A research assistant then made the first phone call the following week to answer any questions and remind the families of the study. If the packet was not received by the pain clinic the following week, a research assistant made a second call that week. If the packet was not received two weeks later, a research assistant then made a third and final call. When possible, voicemails were left with a call back number to the pain clinic research psychologist if direct contact could not be made.

As part of this ongoing longitudinal study, the number of pain clinic visits was tracked for each family that consented to be part of the study. Specifically, the number of exclusively medical, exclusively psychological, combined (i.e., medical and psychological), and total number of visits were tracked for the 455 families in the longitudinal study.

The treatment families receive at the interdisciplinary pain clinic is not standardized or protocolized. Consequently, there was variability in the specific interventions that families received. Nonetheless, there were common components that are worth detailing. During the intake interview, the pain team members (e.g., medical doctor, therapist, nurse) collaboratively assessed numerous factors with the family, including pain/medical history, cognitive-behavioral factors, emotional factors, family environment and the family's experience with the health care system. In addition, the

family was presented with a biopsychosocial perspective of pain, including the ideas that pain is both a physical and psychological phenomenon and that feelings and thoughts can influence the experience of pain. After the thorough assessment and education of the biopsychosocial perspective, a treatment plan was collaboratively created between the pain team members and the family. Treatment plans may have included medication management, cognitive-behavioral therapy, collaboration with family members, collaboration with school, and physical therapy. Notably, cognitive-behavioral therapy was recommended for about 70% of the families, and therapy can be received at the pain clinic or elsewhere. Therefore, cognitive-behavioral therapy in this study was also not standardized or protocolized.

Measures

Background information.

Parent participants were only asked to report standard demographic information on their child (not about themselves). Such information included age, ethnicity and gender. In addition, as part of the semi-structured interview with the pain team, youth provided their usual pain intensity rating on a scale of 0 (no pain) to 10 (most pain possible) and pain duration. Pain duration was categorized as follows: 0-3 months, 3-6 months, 6-12 months, > 1 year, > 2 years, or > 3 years. Pain frequency was ascertained from an item in an intake questionnaire asking how many days in the past two weeks the child had experienced pain.

The demographics and pain-related characteristics of the 192 youth in the present study can be found in Table 1. The majority of the youth participants were female (73.9%) and White (86.1%), with a mean age of 13.9 years (*SD* = 2.4). The three most

common primary pain locations were reported to be head (36.3%), abdomen (18.1%), and back (13.7%). More than half of the youth participants (56.7%) reported having pain for at least a year by the time of their intake appointment, and the mean number of days of experiencing pain the past two weeks was 11.0 (*SD* = 4.0). Lastly, the mean usual pain intensity rating on a scale of 10 was 5.47 (*SD* = 2.62).

Pediatric Quality of Life Inventory (PedsQL™ 4.0).

The PedsQL™ is a brief, 23-item standardized questionnaire that assesses pediatric patient and parent proxy ratings of child HRQOL (Varni, Seid, & Rode, 1999). The PedsQL™ is distinctly different from the FIM as it is a measure of youth-reported HRQOL and parents' perceptions of the child's HRQOL. In contrast, the FIM measures parental perceptions of their own HRQOL and family functioning. The items on the PedsQL™ are reverse-scored and linearly transformed to a 0 to 100 scale such that higher scores indicate better child HRQOL. The psychometric properties have been discussed in the literature review section.

Family Impact Module (FIM).

Parent participants completed the FIM (Varni et al., 2004). The FIM measures parents' self-reported HRQOL and family functioning. The FIM is a measure of parents' perceptions of their own HRQOL and the influence of their child's health condition on parental HRQOL and family functioning. The FIM consists of a total of 36 items and includes the following subscales: Physical Functioning (e.g., "I get headaches") (6 items), Emotional Functioning (e.g., "I feel frustrated") (5 items), Social Functioning (e.g., "It is hard to find time for social activities") (4 items), Cognitive Functioning (e.g., "It is hard for me to think quickly") (5 items), Communication (e.g., "It is hard for me to tell doctors

and nurses how I feel") (3 items), Worry (e.g., "I worry about my child's future") (5 items), Daily Activities (e.g., problems with…"Feeling too tired to find household tasks") (3 items), and Family Relationships (e.g., problems with…"Stress or tension between family members") (5 items). An overall Total score is computed by averaging all 36 items. A Parent HRQOL Summary score is computed by averaging the 20 items comprising the Physical, Emotional, Social, and Cognitive Functioning scales. The Family Functioning Summary score is computed by averaging the 8 items comprising the Daily Activities and Family Relationships scales. The items on the FIM are reverse-scored and linearly transformed to a 0 to 100 scale such that higher scores indicate better HRQOL, or *less* negative family impact. The two Summary scores were used in the present study as indicative of parental HRQOL and family functioning. The psychometric properties have been discussed in the literature review section.

Data Analytic Plan

Descriptive statistics were conducted to determine mean pain ratings and durations of children participants, along with demographics and PedsQL™ and FIM scores across the four times waves. Cronbach alphas were computed for all the PedsQL™ and FIM scores across the four times waves to ensure acceptable internal consistency.

A series of analyses were conducted to examine if the families in the present study differed from those families that were not in the study. First, demographics (i.e., child age, child gender, child ethnicity) and pain characteristics (i.e., pain intensity, duration, frequency) of children who presented to the pain clinic between November 2009 and October 2012 were compared through independent sample t-test or phi analyses by their inclusion status in the present study. Next, independent sample t-tests were

conducted to compare the mean intake child HRQOL, parental HRQOL, and family functioning scores between families who were in the present study to those who were not. The families who consisted of the comparison group were families who presented to the pain clinic for an intake visit between November 2009 and October 2012. Next, since the number of pain clinic visits were tracked for the 454 families in the longitudinal study, independent sample t-tests were conducted to compare the number of exclusively medical, exclusively psychological, combined, and total visits by their inclusion status in the present study. This analysis was conducted to see if the families in the present study were more engaged with the pain clinic, operationally defined by the number of different types of pain clinic visits, than families not in the present study. Lastly, a series of one-factor ANOVAs were conducted to compare the intake child HRQOL, parental HRQOL, and family functioning scores by the number of different type (i.e., medical, psychological, combined, total) of pain clinic visits among the families in the longitudinal study. These ANOVAs were conducted to see if child HRQOL, parental HRQOL, and family functioning intake scores differed by the families' eventual engagement with the pain clinic.

To test the first hypothesis of whether child HRQOL, parental HRQOL, and family functioning improve significantly over the first 3 months of treatment, three one-factor ANOVAs were created with time as the factor. If significant differences were found, follow-up t-tests were conducted with Bonferroni's corrections to determine which time waves were significantly different from each other (Field, 2009). Using G*Power 3.1.2 (Faul, Erdfelder, Buchner, & Lang, 2009) to determine sample size given a small effect size of η^2 of 0.01 (Cohen, 1988), the estimated required sample size was 5,150. The

estimated required sample size was 594 with a medium effect size of 0.059, and the estimated required sample size was 110 with a large effect size of 0.138. Therefore, with the sample size of 192 families, the present study was adequately powered for a large effect size but not small or medium effect sizes. This limited power was managed by examining effect sizes as well as significance tests.

To test the second hypothesis regarding earlier family variables predicting later child HRQOL, a series of hierarchical regression models were created with family variables (i.e., parental HRQOL, family functioning) as independent variables and child HRQOL as the dependent variable. To control for demographic and pain characteristics, demographic variables (i.e., child age, child gender) were entered in the first step while pain characteristics (i.e., pain intensity, pain duration, pain frequency) were entered in the second step. The third and final step included the family variable (i.e., parental HRQOL or family functioning). Refer to Table 2 for the organization of these hierarchical regression models. In the first pair of regression models, the mother reported intake family variables (i.e., parental HRQOL, family functioning) were the independent variables, predicting child HRQOL at 1-month. The second pair of regression models were the same intake family variables predicting child HRQOL at 3 months. The last pair of regression models were the family variables at 1 month predicting child HRQOL at 3 months.

Notably, father-reported parental HRQOL and family functioning were not entered in the third and final model of the hierarchical regression models for the main analyses due to low response rates. Explicitly, of the 192 families included in the present study, there was data from 91 fathers at intake, 107 fathers at 1 month and 66 fathers at 3

months. In order not to substantially decrease the sample sizes of the hierarchical regression models, father-reported data was excluded for the main analyses. The same hierarchical regression analyses, with father-reported parental HRQOL and family functioning entered simultaneously with mother-reported parental HRQOL and family functioning in the third and final model, were conducted as analyses for the appendix.

Using G*Power 3.1.2 (Faul, Erdfelder, Buchner, & Lang, 2009) to determine sample size given a small effect size of f^2 of 0.02 (Cohen, 1988), the estimated required sample size was 776. Notably, the estimated required sample size was 107 with a medium effect size of 0.15, and the estimated required sample size was 48 with a large effect size of 0.35. Therefore, the present study was adequately powered with 192 participants with a medium and large effect size, but was likely underpowered for small effect sizes.

The third hypothesis regarding the predictive value of intake and 1-month family variables in predicting child HRQOL were tested by comparing the f^2 effect sizes of the regression models using intake family variables to the regression models using 1-month variables. The following interpretations were used for effect size values: small (>0.02), medium (>0.15), and large (>0.35) (Cohen, 1988).

Lastly, as exploratory analysis to gauge the predictive ability of family variables of child functioning after 1 year, Pearson correlations were conducted between child HRQOL scores at 1 year and mother-reported parental HRQOL and family functioning at intake, 1-month and 3-months post intake.

Results

The means and standard deviations of the PedsQL^{TM} Total and FIM Summary Scales over the four time waves (i.e., intake, 1-month, 3-months, 1-year) are displayed in Table 3. Table 4 displays the Cronbach alpha scores of the same scales over the four time waves. Notably, mean scores of these scales increased over the four time waves, with accompanying sample sizes decreasing. Overall, the five scales demonstrated excellent internal consistency across the four time waves, with all alpha scores above 0.9.

Comparisons of Participants to Non-Participants

The demographic and pain characteristics of child participants were compared to the characteristics of child patients who were not included in the study and presented to the pain clinic during the same period of time. Independent sample t-test revealed that child participants did not differ significantly from other child patients in terms of age (M = 13.9 years, SD = 2.4 and M = 13.6 years, SD = 3.3, respectively; t (856) = 1.49, p= .137), pain intensity (M = 5.5, SD = 2.6 and M = 5.6, SD = 2.4, respectively; t (680) = 0.56, p= .578), and pain frequency (M = 11.0 days, SD = 3.9 and M = 10.7 days, SD = 4.1, respectively; t (702) = 0.79, p= .432). Phi analyses revealed that child participants did not differ significantly from other child patients in terms of pain location (*phi* (10) = .079, p = .888) or duration of pain (*phi* (6) = .082, p = .559). However, significant differences were found between participants and children not in the study in terms of gender (73.9% female and 65.2% female, respectively; *phi* (1) = .077, p = .025) and ethnicity (81.9% White and 72.8% White, respectively; *phi* (8) = .159, p = .007). In sum, child participants had a higher percentage of females and Whites as compared to non-

participants, but were found to be similar across all other demographic and pain characteristics.

As depicted in Table 5, independent sample t-tests were conducted to compare the intake scores on the PedsQL^{TM} and FIM of participant and non-participant families. No significant differences were found across the five scales, indicating that participant families did not differ from non-participant families in terms of child HRQOL, mother HRQOL, father HRQOL, mother-reported family functioning, and father-reported family functioning at intake.

As the number of different types of pain clinic visits were tracked for the 454 participants in the longitudinal study, the mean numbers of visits were compared through independent sample t-tests of participant and non-participant families. As noted in Table 6, participant families had significantly more exclusively medical (t (452) = 3.94, p <.001), combined (t (452) = 3.12, p =.002) and total pain clinic visits (t (452) = 3.86, p <.001) than non-participants. The number of exclusively psychological visits did not differ significantly between participants and non-study participants, but approached significance (t (452) = 1.86, p =.063).

Next, one-way ANOVAs were conducted to examine if the number of different types of pain clinic visits was associated with intake scores on the PedsQL^{TM} and FIM. As indicated in Tables 7-10, the number of exclusively medical, exclusively psychological, combined, and total pain clinic visits were not significantly associated with intake scores of child HRQOL, mother HRQOL, father HRQOOL, mother-reported family functioning, or father-reported family functioning. Additionally, all of the effect sizes were in the negligible to small range. Therefore, while participants were found to

have significantly more pain clinic visits than non-participants, the numbers of pain clinic visits were not found to be associated with intake scores.

Hypothesis #1: Improvement Over Time

A series of repeated measures ANOVAs were conducted to examine if child HRQOL, parental HRQOL, and family functioning improved in the 3 months after intake. As indicated in Table 11, child HRQOL significantly increased over time (F (2, 184) = 9.97, p <.001) with a large effect size (η_p^2= .167). Follow-up t-tests with Bonferroni corrections indicated that the 3-month mean score (65.8, SD = 18.6) was significantly higher than the mean intake score (59.0, SD = 16.3). With regards to mother-reported scores, both mother HRQOL (F (2, 176) = 1.15, p= .320) and family functioning (F (1.82, 162.34) = 1.61, p= .205) did not significantly increase over time, although time had a small effect size on both scores (η_p^2 = .013 and η_p^2 = .027, respectively). With regards to father-reported scores, father HRQOL significantly increased over time (F (1.49, 56.51) = 3.78, p <.041) with a medium effect size (η_p^2 =.090). Follow-up t- tests with Bonferroni corrections indicated that the 3-month mean score (83.2, SD = 17.2) was significantly higher than the mean 1-month score (77.2, SD = 19.8). Father-reported family functioning did not significantly improve over time (F (2, 74) = 1.55, p =.219), although time did have a small effect size on family functioning scores (η_p^2 =.040). Therefore, the first hypothesis was partially supported as only child HRQOL and father HRQOL were observed to significantly increase over time.

Hypothesis #2: Early Family Variables Predicting Later Child HRQOL

As depicted in Tables 12-14, a series of hierarchical regression models were created to assess if earlier family variables predict later child HRQOL. Table 12 displays

the results of using the intake family variables (i.e., mother HRQOL, family functioning) to predict 1-month child HRQOL. The initial step of child demographic characteristics (i.e., gender, age) did not significantly predict child HRQOL at 1-month (F (2, 144) = 2.70, R^2 = .036, p= .071), but the second step with pain characteristics (i.e., intensity, duration, frequency) did significantly predict child HRQOL at 1 month (F (5, 141) = 4.14, R^2 = .128, p_Δ= .003). The final and third step involved adding either mother HRQOL at intake or mother-reported family functioning. When mother HRQOL at intake was added to the model, significantly more variance was accounted for in child HRQOL at 1 month (F (6, 140) = 7.30, R^2 = .238, p_Δ< .001), with this change in variance accounted for being of medium effect size (f^2_Δ= .144). When mother-reported family functioning at intake was added to the model instead, significantly more variance was accounted for in child HRQOL at 1 month (F (6, 140) = 6.57, R^2 = .220, p_Δ< .001), with this change in variance accounted for being nearly of medium effect size (f^2_Δ= .117). Therefore, the second hypothesis was supported as the intake family variables were found to significantly predict 1-month child HRQOL, above and beyond demographic and pain characteristics.

Table 13 displays the results of using the intake family variables to predict 3-month child HRQOL. The initial step of child demographic characteristics did not significantly predict child HRQOL at 3 months (F (2, 98) = 0.95, R^2 = .019, p= .390), but the second step with pain characteristics did significantly predict child HRQOL at 3 months (F (5, 95) = 2.36, R^2 = .110, p_Δ= .025). When mother HRQOL at intake was added to the model as the third step, significantly more variance was accounted for in child HRQOL at 3 months (F (6, 94) = 4.54, R^2 = .225, p_Δ< .001), with this change in

variance accounted for being of medium effect size (f^2_Δ= .147). When mother-reported family functioning at intake was added to the model instead, significantly more variance was accounted for in child HRQOL at 3 months (F (6, 94) = 4.00, R^2 = .203, p_Δ< .001), with this change in variance accounted for being nearly of medium effect size (f^2_Δ= .117). Therefore, the second hypothesis was supported as the intake family variables were found to significantly predict 3-month child HRQOL, above and beyond demographic and pain characteristics.

Lastly, Table 14 displays the results of using 1-month family variables to predict 3-month child HRQOL. The initial step of child demographic characteristics did not significantly predict child HRQOL at 3 months (F (2, 93) = 0.90, R^2 = .019, p= .409), but the second step with pain characteristics did significantly predict child HRQOL at 3 months (F (5, 90) = 2.23, R^2 = .110, p_Δ= .031). When mother HRQOL at 1 month was added to the model as the third step, significantly more variance was accounted for in child HRQOL at 3 months (F (6, 89) = 4.31, R^2 = .225, p_Δ< .001), with this change in variance accounted for being of medium effect size (f^2_Δ= .148). When mother-reported family functioning at 1 month was added to the model instead, significantly more variance was accounted for in child HRQOL at 3 months (F (6, 89) = 5.18, R^2 = .259, p_Δ< .001), with this change in variance accounted for being of medium effect size (f^2_Δ= .200). Therefore, the second hypothesis was supported as the 1-month family variables were found to significantly predict 3-month child HRQOL, above and beyond demographic and pain characteristics. In sum, all six hierarchical regression models supported the second hypothesis that earlier family variables would be predictive of later child HRQOL, above and beyond demographic and pain characteristics.

Hypothesis #:2: Inclusion of Father-Reported Data to Predict Later Child HRQOL

The appendix displays the results of the same hierarchical regression analyses, except with father-reported data entered with mother-reported data in the third and final steps. These analyses are in the appendix as the inclusion of father-reported data greatly decreased the sample sizes. When intake mother and father HRQOLs were entered in the third step (Appendix A1), significantly more variance was accounted for in child HRQOL at 1 month (F (7, 72) = 4.30, R^2 = .292, p_Δ< .001). This change in accounted variance was of medium effect size (f^2_Δ= .117). When both mother and father-reported family functioning at intake were entered in the third step (Appendix A1), significantly more variance was accounted for in child HRQOL at 1 month (F (7, 71) = 3.70, R^2 = .267, p_Δ= .002). This change in accounted variance was of medium effect size (f^2_Δ= .117). In sum, intake family variables were predictive of child HRQOL at 1 month, above and beyond demographic and pain characteristics.

Similar results were observed when the same intake family variables were used as predictors of child HRQOL at 3 months (Appendix A2). When intake mother and father HRQOLs were entered in the third step as predictors of child HRQOL at 3 months, significantly more variance was accounted for (F (7, 47) = 3.76, R^2 = .359, p_Δ< .001). This change in accounted variance was of large effect size (f^2_Δ= .387). When both mother and father-reported family functioning at intake were entered in the third step as predictors of child HRQOL at 3 months, significantly more variance was accounted for (F (7, 47) = 4.60, R^2 = .407, p_Δ< .001). This change in accounted variance was of large effect size (f^2_Δ= .500). In sum, intake family variables were predictive of child HRQOL at 3 months, above and beyond demographic and pain characteristics.

Family variables at 1 month were also found to be predictive of child HRQOL at 3 months (Appendix A3). When mother and father HRQOLs at 1 month were entered in the third step as predictors of child HRQOL at 3 months, significantly more variance was accounted for (F (7, 56) = 2.86, R^2 = .263, p_Δ= .005). This change in accounted variance was of medium effect size (f^2_Δ= .208). When both mother- and father-reported family functioning were entered in the third step as predictors of child HRQOL at 3 months, significantly more variance was accounted for (F (7, 56) = 4.33, R^2 = .351, p_Δ< .001). This change in accounted variance was of large effect size (f^2_Δ= .371). In sum, earlier family variables, as reported by both mothers and fathers, were also found to be predictive of later child HRQOL, above and beyond demographic and pain characteristics. Therefore, the results of these series of six hierarchical regression models were also supportive of the second hypothesis.

Hypothesis #3: Predictive Utility of Intake and One-Month Family Variables

The effect sizes (f^2_Δ) of the hierarchical regression models using intake family variables to predict 3-month child HRQOL (i.e., Table 13) were compared to the effect sizes of the hierarchical regression models using 1-month family variables (i.e., Table 14) to assess the predictive utility of intake family variables to post-intake family variables. The effect sizes of the two hierarchical regression models using mother HRQOL at intake or 1 month as the last step were nearly identical (f^2_Δ = .147 and f^2_Δ = .148, respectively), and both constitute as nearly medium effect sizes. The effect size of the hierarchical regression model using family functioning at 1 month (f^2_Δ = .200) was larger than the effect size of the hierarchical regression model using family functioning at intake (f^2_Δ = .117). Additionally, the effect size of the hierarchical regression model using family

functioning is considered to be medium sized while the hierarchical regression model using family functioning at intake is considered approaching medium sized. In sum, the hypothesis that 1-month family variables would be found to be more predictive of child HRQOL at 3 months than intake family variables was only partially supported.

Similar comparisons can be made between the hierarchical regression models that included father-reported data to predict child HRQOL at 3 months (Appendices A2-A3). In comparing the effect sizes of the hierarchical regression models using parental HRQOL, one finds that the model using parental HRQOL at intake had a larger effect size ($f^2_\Delta = .387$) than the model using parental HRQOL at 1 month ($f^2_\Delta = .208$). Additionally, the effect size of the model using parental HRQOL at intake is considered to be of large size, while the effect size of the model using parental HRQOL at 1 month is considered to be of medium size. This difference is the opposite of what was hypothesized as the parental HRQOL at intake was more predictive of child HRQOL at 3 months than parental HRQOL at 1 month. Similar unexpected results were observed in comparing the predictive utility of family functioning at intake and 1 month. The effect size of the hierarchical regression model using family functioning at intake ($f^2_\Delta = .500$) was larger than the effect size of the model using family functioning at 1 month ($f^2_\Delta = .371$) to predict child HRQOL at 3 months. Notably, both effect sizes are considered to be large effect sizes. In sum, the hierarchical regression models that included father-reported data found the family variables at intake to be more predictive of child HRQOL at 3 months than the family variables at 1 month. These results are the opposite of what was hypothesized.

Exploratory Analysis with One-Year Data

The zero-order correlations between 1-year child HRQOL scores and FIM scores from intake, 1-month and 3-months are displayed in Table 15. Across the three time waves and four FIM scores in each time wave (i.e., 12 total correlations), only the correlation between fathers' reports of family functioning at 3 months and child HRQOL at 1 year was significant (r (28) = .436, p = .020). Overall, there was a lack of statistical support for early family variables being predictive of child HRQOL at 1 year after intake.

Discussion

The main purpose of the present study was to assess if parent and family functioning were predictive of later child functioning in families seeking interdisciplinary treatment of pediatric chronic pain. The results of the study showed that there is a positive relationship between parent/family functioning and later child functioning, after controlling for demographic and pain characteristics. Therefore, the results of the study are consistent with theoretical frameworks that posit the family context as influential in the child's coping with chronic pain. This creates support for a paradigm shift that would suggest that the well being of parents and families should be a direct target of the integrated treatment for pediatric chronic pain in many families. At a minimum, treatments should assess not only the child's functioning, but the parents' and families' functioning as well. Children with chronic pain function best in the long-term when their parents and families are functioning well.

Comparability of Pain Clinic Population to Study Sample

While 915 families arrived at the chronic pain clinic during the duration of the longitudinal study, only 192 (21.0%) families were included in the present study. Consequently, a series of statistical analyses were conducted on the available data to assess the ways the present study's sample differed from the families not included in the study. As part of the intake process at the interdisciplinary pain clinic, families report demographic and chronic pain information; as well as complete several forms, including the PedsQL^{TM} and FIM.

In comparing the demographic and pain characteristics, the present study's sample was found to consist of more female and White children. No other pain (i.e., intensity,

duration, location) or demographic (i.e., age) characteristics were found to be significantly different between participants and non-participants. The intake scores of child HRQOL, mother HRQOL, father HRQOL, and family functioning did not differ by the inclusion status into the present study.

As part of the longitudinal study, the number and different types of pain clinic visits were tracked for each family. Independent sample t-tests revealed that participants in the present study had significantly more exclusively medical, combined, and total pain clinic visits than non-participants. However, through a series of one-way ANOVAs, no significant associations were found between the type and number of pain clinic visits and child HRQOL, parental HRQOL, and family functioning at intake. Therefore, while participants of the study as a group attended significantly more pain clinic visits, this greater future engagement with the pain clinic was not associated with child and family functioning at intake.

In sum, analyzing the available data revealed that participants in the present study differed from non-participating families from the pain clinic in terms of child ethnicity (i.e., more Whites in present study), child gender (i.e., more females in present study), and eventual number of pain clinic visits. No differences were found in terms of other demographic characteristics, pain characteristics, child HRQOL, parental HRQOL, and family functioning. Given the lack of differences in terms of pain characteristics and level of child/parent/family functioning, the sample of the present study was viewed as being fairly representative of the chronic pain clinic's larger population.

Hypothesis Testing

The results of the hypothesis testing are summarized in Table 16. The first hypothesis stipulated that child HRQOL, parental HRQOL, and family functioning would all increase in the first 3 months of treatment. A series of repeated measures ANOVAs were conducted, and the results indicated that only child HRQOL and father HRQOL significantly improved over the first 3 months of treatment. Mother HRQOL and both father- and mother-reported family functioning did not significantly improve over time. Therefore, the first hypothesis was only partially supported.

Since the treatment administered at the chronic pain clinic is intended to increase children's functioning, the observed increase in child HRQOL is not unexpected. However, the treatment does not directly address parent and family functioning, so it is noteworthy that all mean scores increased over time and that father HRQOL did so significantly. The lack of significant increases in these scores outside of child HRQOL and father HRQOL may be a result of longitudinal attrition. As repeated measures ANOVAs were conducted to detect change in scores over time, the only cases that were included in analyses were of those participants who completed the measures across all three time waves. Consequently, the study's sample size of 192 was 93 at its highest for these analyses and 38 at its lowest. Notably, time had at least a small effect size on all parental HRQOL and family functioning scores, thus suggesting that larger sample sizes would lead to significant findings.

The second hypothesis stipulated that earlier (i.e., intake, 1-month) family variables (i.e., mother HRQOL, family functioning) would predict later (i.e., 1-month, 3-months) child HRQOL, above and beyond children’s demographic and pain

characteristics. As described in Table 2, a series of six hierarchical regression models were created where demographic characteristics, pain characteristics, and a family variable were added in separate steps to predict child HRQOL. In all six hierarchical regression models, earlier mother HRQOL or family functioning significantly predicted later child HRQOL, above and beyond demographic and pain characteristics. Notably, the change in variance accounted for by mother HRQOL and family functioning in these hierarchical regression models was of medium or nearly medium effect size. Therefore, the second hypothesis was fully supported by the results of these analyses.

Notably, the second hypothesis was also supported when similar hierarchical regression models were created that added father-reported father HRQOL or family functioning alongside mother-reported mother HRQOL or family functioning in the final step. These hierarchical regression models were considered auxiliary analyses as the inclusion of father-reported data greatly decreased the sample sizes of these regression models. In all six hierarchical regression models, earlier parental HRQOL or family functioning significantly predicted later child HRQOL, above and beyond demographic and pain characteristics. Notably, the change in variance accounted for by parental HRQOL and family functioning in these hierarchical regression models was of medium to large effect size. Therefore, these auxiliary analyses also supported the second hypothesis that earlier family variables would be predictive of later child HRQOL.

The third hypothesis stipulated that the family variables at 1 month would have a higher predictive utility than the family variables at intake in predicting child HRQOL at 3 months. The effect sizes of the hierarchical regression models utilizing mother HRQOL at intake and 1-month were nearly identical. In contrast, the effect size of the hierarchical

regression model utilizing family functioning at 1 month was larger (i.e., medium effect size) than the effect size of the hierarchical regression model utilizing family functioning at intake (i.e., approaching medium effect size). Therefore, the third hypothesis was partially supported.

Notably, the auxiliary hierarchical regression models that included father data contradicted the third hypothesis. The effect sizes of the hierarchical regression models utilizing parental HRQOL and family functioning at intake were larger than the effect sizes of the hierarchical regression models utilizing parental HRQOL and family functioning at 1 month. In other words, contrary to what was hypothesized, the family variables at intake were more predictive of child HRQOL at 3 months than family variables at 1 month.

In sum, there was inconsistent support for the third hypothesis as one-month family variables were not consistently better predictors of child HRQOL than intake family variables. This may be a reflection that this hypothesis was based on the results of a pilot study with 1 month follow up data on only 19 participants (Bernacki et al., 2012), so the study's conclusions were tenuous. Given that the increases in parental HRQOL and family functioning observed in the present study were of mostly small effect sizes over the first 3 months of treatment, it is also possible that there is no substantive difference in intake and 1-month family variables in terms of predictive utility of future child functioning. Clearly, more study is needed with larger sample sizes to ascertain the temporal dynamics of child and parent/family functioning over the course of treatment of pediatric chronic pain.

Exploratory Analysis with One-Year Data

Outside of the one significant correlation between fathers' report of family functioning at 3 months and child HRQOL at 1 year, there was a lack of support for there being a relationship between early family variables and child functioning 1 year post intake. However, due to a greater attrition for the 1-year data point, the sample sizes in the correlational analysis ranged from 28 to 51 cases. Notably, five of the twelve correlations listed in Table 15 are greater than r =0.2, including fathers' reports of family functioning across all three time waves. The magnitude of these correlations suggests that greater sample sizes would likely lead to significant correlations.

Implications

Strengths of present study.

The primary aim of the present study was to elucidate how the family context influences the child's functioning over the course of interdisciplinary treatment of pediatric chronic pain. As stipulated by multiple theories, the family context can be influential in how a child copes and manages having an illness (e.g., McCubbin & Patterson, 1982; Wallander, Varni, Babani, & Wilcox, 1989; Minuchin et al., 1975), including chronic pain (Palermo & Chambers, 2005). Specifically, the study was designed to assess if family and parent functioning are predictive of child functioning during the first 3 months of treatment. A strength of the present study was that child HRQOL and parental HRQOL were not assessed by proxy, but rather by self-report. In particular, collection of self-reported child HRQOL has been recommended as a child's report may be a more accurate reflection of their HRQOL (Varni, Limbers, & Burkwinkle, 2007).

Another strength of the study was its focus on child functioning rather than pain reduction. While pain characteristics were included in this study as control variables in hierarchical regression models, the dependent variable in these models was child HRQOL; as child functioning, and not pain reduction, has been cited as the appropriate goal of pediatric chronic pain treatment (American Pain Society, 2001; Bursch, Joseph, & Zeltzer, 2003; Zeltzer, Tsao, Bursch, & Myers, 2006). Additionally, the study was conducted in a naturalistic fashion meaning that the study did not interfere in the application of interdisciplinary treatment that was individually tailored by clinicians to fit with the patient's presenting problem. Also, the demographics of the participants of the current study appear to be similar to that of other participants in studies taking place in chronic pain clinics (Eccleston, Morley, Williams, Yorke, & Mastroyannopoulou, 2002; Palermo, Eccleston, Lewandowski, Williams, & Morley, 2009). Consequently, the results of this study are seen as clinically relevant as the interdisciplinary treatment children and families received in this study is viewed as optimal (Pain Society, 2001; Bursch, Joseph, & Zeltzer, 2003).

Theoretical implications.

Overall, the results of this study support the Integrative Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability (Palermo & Chambers, 2005). Referring to the model in Figure 1, one sees that both family variables, family functioning and parental HRQOL, were longitudinally associated with child functioning. Given the paucity of literature that documents this connection between family variables and child functioning in families dealing with pediatric chronic pain, the present study is a contribution to the field of pediatric psychology. The results of the

current study encourage further research into how the family context influences functioning in children dealing with chronic pain. Additionally, with the inclusion of pain characteristics (i.e., duration, intensity, frequency) in the second step of hierarchical regression models, one can see that while these pain characteristics are predictive of child functioning, both of the study's family variables are uniquely predictive of future child functioning.

Another contribution of the present study is its inclusion of child age and gender as such demographic characteristics have rarely been analyzed in treatment studies (Palermo, Eccleston, Lewandowski, Williams, & Morley, 2009). Notably, the results of the hierarchical regression models do not support the supposition of the Integrative Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability that these demographic factors influence child functioning. In the first step of the hierarchical regression models where these demographic factors were entered as predictors of later child functioning, these factors did not significantly predict child functioning in any of the six models. Consistent with other pediatric chronic pain studies, the sample consisted of more adolescents and female patients, but the restricted ranges of these demographic variables may have influenced these results. In sum, the results of this study support the key theoretical suppositions of the Integrative Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability and encourage further research into the influence of family variables on child functioning in children dealing with chronic pain.

Clinical implications.

The present study also has clinical implications. While the treatment that families received did not explicitly or systematically focus on the family context, the results indicated that parent and family functioning are longitudinally associated with child functioning. Given the theoretical (e.g., McCubbin & Patterson, 1982; Wallander, Varni, Babanis, & Wilcox, 1989; Minuchin et al., 1975; Palermo & Chambers, 2005) and empirical support (e.g., Palermo & Eccleston, 2009; Kazak, Rourke, & Navsaria, 2009; Logan & Scharff, 2005; Simons, Claar, & Logan, 2008; Crushell et al., 2003; Welkom, Hwang, & Guite, 2013) for the influence of the family context on child functioning, optimal treatment of pediatric chronic pain likely benefits from family involvement.

For families dealing with pediatric chronic pain, the results of the present study have a clear message for them: how well the child's parents and family cope with the chronic pain can influence how well the child is able to function. In fact, the parents' reports of their own HRQOL and family functioning were *more* predictive of future child HRQOL than any of the demographic and pain characteristics. Therefore, based on the results of this study, parents can be told that how well they and their family function may be more important in determining how well the child copes with chronic pain than the severity of their child's pain. Given the increases in parental and familial stress that come with pediatric chronic health conditions (Palermo & Eccleston, 2009; Kazak, Rourke, & Navsaria, 2009; Robinson, Gerhardt, Vannatta, & Noll, 2007; Friedman, Holmbeck, Jandasek, Zukerman, & Abad, 2004), the results of this study indicate that children with chronic pain would be well served if their parents also take care of themselves.

While there have been a few treatment studies that focused on family variables (e.g., Sanders et al., 1989; Robins, Smith, Glutting, & Bishop, 2005; Welkom, Hwang, & Guite, 2013), the results of this study suggest that clinical techniques should be developed to make family involvement a key aspect of the interdisciplinary treatment of pediatric chronic pain. For example, the current treatment study included children and parents jointly receiving psychoeduation on the biopsychosocial perspective of pain during their intake. Additionally, clinicians in the pain clinic assess for family factors and integrate them into the individualized treatment plans. Parental behaviors like protective parental responses can be included in such treatment plans (Welkom, Hwang, & Guite, 2013). Therefore, the parental coaching described in Robins and colleagues' (2005) treatment study is an example of a clinical technique that may effectively integrate family involvement into the treatment of pediatric chronic pain. These clinical techniques merit consideration to not only be studied but to also become a standard component of the treatment of pediatric chronic pain.

Importance of fathers.

An auxiliary aim of the present study was to investigate the influence of both mother and father functioning, as well as their reporting of family functioning, on child functioning. There have been calls in pediatric psychology to include father data given the dearth of such data in the field to gain a deeper understanding of how the family context influences the management of pediatric chronic illnesses (e.g., Seagull, 2000; Phares, Lopez, Fields, Kamboukos, & Duhig, 2005). Unfortunately, while approximately 94% of returned (intake, 1-month and 3-month) questionnaire packets were completed by mother and child, only 47% of returned questionnaire packets were completed by father,

mother, and child. Consequently, the decision was made to limit the main analyses to mother and child data to increase sample size and generalizability of the study. Intent to treat analyses were not used as the primary focus of the study was the longitudinal associations between child HRQOL and family variables, so the use of conservative estimates for the independent variables (i.e., family variables) was deemed inappropriate.

Auxiliary analyses were conducted where both mother and father data were included in the third and final step in the series of hierarchical regression models. While keeping in mind that these hierarchical regression models have greatly reduced sample sizes, the greater variances accounted for and larger effect sizes attained by these models in comparison to the ones found in the main analyses is noteworthy. Comparing the results of these hierarchical regression models suggests that a better understanding of how the family context influences how a child functions with chronic pain requires input from both mothers and fathers. Notably, this is the case when looking at parental HRQOL *and* family functioning, indicating that while both mothers and fathers may be reporting on the same construct, fathers' perspectives on how well their families function accounts for unique variance in future child HRQOL. This observation is unexpected as the author's master's thesis, which examined dyadic parental differences on the FIM from the same chronic pain clinic, found that mothers and fathers did not significantly differ in their reports of family functioning (Medrano, 2011).

To evaluate if fathers' reports of parental HRQOL and family functioning accounted for unique variance, separate from mothers' report, the zero-order, partial and semi-partial correlations were examined from the hierarchical regression models found in Appendices A1-A3. Refer to Appendices A4-A6 for the tables of these correlations.

While zero-order correlations indicate the total shared variance between two variables, partial and semi-partial correlations indicate the unique variance between two variables by removing the accounted variance from other variables (Cohen, Cohen, West, & Aiken, 2003). Specifically, a partial correlation is the ratio of variance in the dependent variable (i.e., child HRQOL) that is associated with the independent variable of interest and not associated with other independent variables. In contrast, a semi-partial correlation is the correlation between the dependent variable (i.e., child HRQOL) and the independent variable of interest when the shared variance of the independent variable and other independent variables has been removed but not the shared variance between the dependent variable and other independent variables (Cohen et al., 2003; Field, 2009). Across all six hierarchical regression models, the fathers' reports of their own parental HRQOL and family functioning had higher partial and semi-partial correlations with child HRQOL than mothers' reports of their own parental HRQOL and family functioning. Notably, these partial and semi-partial correlations are including the other predictors (i.e., child gender, child age, pain intensity, pain duration, pain frequency). Therefore, these correlational analyses and auxiliary hierarchical regression models suggest that fathers' HRQOL and their report of family functioning may be better predictors of later child HRQOL than mothers' reports in families receiving treatment for pediatric chronic pain. These findings are consistent with previous research that found that only the fathers' reports of family stress and family resources were significantly associated with metabolic control in families dealing with pediatric diabetes (Auslander, Bubb, Rogge, & Santiago, 1993). However, these interpretations are tenuous as they come from a smaller subsection of families from the chronic pain clinic that not only

consisted of two-parent homes, but who dutifully and voluntarily completed all three reports. Nonetheless, these results certainly support the calls for greater paternal inclusion in pediatric psychology research to better understand the family context (Seagull, 2000; Phares, Lopez, Fields, Kamboukos, & Duhig, 2005), and suggest that effective family involvement in the treatment of pediatric chronic pain requires both mothers and fathers.

Limitations

While the present study is viewed as a worthwhile contribution, there are several limitations that merit mentioning. First, there was no control group in this longitudinal study, so statements about the effectiveness of the treatment families received must be made cautiously as improvements in functioning may be the result of other factors besides the administered treatment (Kazdin, 2003). Furthermore, treatments were individualized and did not consist of the same components for all families (e.g., CBT, physical therapy, medication management).

Second, as this was a voluntary study, there was substantial missing data across time waves and participant types. While there were 192 families included in the present study, the actual sample sizes varied depending on the analyses as there was generally more missing data in latter time waves and with father-reports. The potential effects these varying and voluntary sample sizes had on analyses and conclusions are unknown, although the present study's sample did not differ from the larger pain clinic intake sample in terms of intake scores and pain characteristics. Notably, the present study's sample constituted of higher percentage of White and female patients, and of families that had more pain clinic visits, than non-participating families. While the reasons for dropping out of the study or not returning questionnaire packets were not systematically

attained and recorded, anecdotally, families have reported being too busy to complete measures, believing the questionnaires do not pertain to their child's condition, or being unsatisfied with the clinical care they received. In sum, there are probably multiple factors that result in families and individuals not participating in the study, and with their data inherently missing, the effects of these unknown factors on the study's results are unknown.

Third, parent and family characteristics, such as parent age and family composition, were not collected in this study. Consequently, the potential influence on child functioning from being raised in a single-parent home versus a two-parent home is not accounted for in this study. Anecdotally, there is a sizeable subset of families being treated at the pain clinic that are single-parent homes, but such salient parent and family characteristics are not accounted for in this study.

Fourth, the key variables in this study (e.g., child HRQOL, parental HRQOL, family functioning) were assessed solely through subjective self-report measures. Ideally, key constructs should be assessed through multiple methods and sources (Kazdin, 2003; Holmbeck, Li, Schurman, Friedman, & Coakley, 2002). In addition, the phenomenon of response shift as it pertains to quality of life (QOL) and management of chronic illnesses was not accounted for in this study. As defined by Sprangers and Schwartz (1999), response shift is "changes in the meaning of one's self-evaluation of QOL resulting from changes in internal standards, values, or conceptualization" (p. 1507). In other words, as HRQOL is a subjective measure of one's well-being, the management of a chronic illness may change a person's view of how onerous the illness' effects are on one's life. This

phenomenon may be an additional explanation as to why HRQOL and family functioning scores did not change more drastically over the course of treatment.

Lastly, the analyses of this study do not capture the probable bidirectional relationship between child and parent/family functioning (Minuchin, Rosman, & Baker, 1978; Palermo & Chambers, 2005). In other words, it is likely that earlier child HRQOL would predict later family variables, just as earlier family variables predicted later child HRQOL.

Future Directions

As was done in the present study, researchers are encouraged to focus on functioning rather than pain reduction, although there are other constructs researchers may use besides HRQOL to assess functioning. Additionally, collecting data from multiple family members should continue. As suggested by Holmbeck and colleagues (2002), multiple measures of family functioning, parent functioning, and child functioning should be collected. For example, to assess child functioning, measures of functional disability (e.g., Child Activity Limitations Questionnaire; Hainsworth, Davies, Khan, & Weisman, 2007) and school avoidance (Khan & Ladwig, 2007) could be collected alongside child HRQOL.

Drawing from the present study's limitations, there are multiple suggestions to be made for future research into how the family context influences child functioning in families receiving treatment for pediatric chronic pain. First, efforts should be made to conduct longitudinal studies with less longitudinal attrition, possibly compensating participants for completion of measures. Also, father data should be collected alongside child and mother data given the results of the auxiliary hierarchical regression models.

Additionally, in order to test more of the suppositions of the Integrative Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability (Palermo & Chambers, 2005), data on parent/family characteristics and the parent-child relationship should be collected. Given that more than half of the study's participants reported having pain for longer than a year, statistical methods of how to account for response shift should be implemented in future studies (Sprangers & Schwartz, 1999). With greater sample sizes and less missing data across time waves and participant types, the use of sophisticated statistical techniques such as structural equation modeling (Ullman & Bentler, 2012) could be utilized to better capture the bidirectional and temporal relationships between child and parent/family functioning.

The greater understanding of how the family context influences child functioning in the treatment of pediatric chronic pain should lead to the development of treatment studies with control groups. Additionally, more studies will be needed to identify potential targets for intervention, such as parental behaviors. For example, Simons, Claar, and Logan (2008) found that adolescents whose parents reported using more protective behavior towards them were more likely to report higher levels of functional disability and somatization. Additionally, Welkom, Hwang and Guite (2013) found that decreases in these protective parental responses led to a decrease in pain catastrophizing and an increase in child functioning. An increase in research like these studies should lead to a list of potential treatment targets, and greater understanding of how familial variables influence the experience of pediatric chronic pain. Additionally, researchers should work to ascertain family characteristics that identify families that would benefit from a family-

based approach. Ideally, these studies could directly inform clinical practice in how to effectively integrate the family into the treatment.

The present study is viewed as fulfilling the initial step in research that will guide clinicians how to effectively integrate families into the treatment of pediatric chronic pain. The present study supported the theoretical suppositions that the family context influences child functioning. Specifically, parental HRQOL and family functioning at intake and 1-month were found to predict later child HRQOL, above and beyond the influence of demographic and pain characteristics. Consequently, clinicians and researchers are encouraged to consider the influence of the family context on children's functioning.

The research required to effectively incorporate families into the treatment of chronic pain will take years to complete. Yet, the development of psychological interventions that address not only the stressed child, but the stressed family, are probably needed for the optimal treatment of pediatric chronic pain in many families. By including families in therapy, treatments may not just improve the child's psychosocial functioning, but improve the entire family's well-being.

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Table 1
Demographics and Pain-Related Characteristics of Child Participants in Dissertation Study (N = 192)

Characteristic	Percentage
Gender	
Male	26.1%
Female	73.9
Ethnicity	
White	86.1%
Black	3.9
Latino	4.4
Biracial	3.3
Other	2.3
Age (years)	
8	3.7
9	2.7
10	2.1
11	8.0
12	11.7
13	8.5
14	16.0
15	14.9
16	18.1
17	13.3
18	1.1

Table 1 (continued)
Demographics and Pain-Related Characteristics of Child Participants in Dissertation Participants (N = 192)

Characteristic	Percentage
Primary Pain Location	
Head	36.3%
Jaw	0.5
Neck	1.1
Upper Extremity	4.9
Chest	1.6
Abdomen	18.1
Back	13.7
Lower Extremity	12.6
Joints	0.5
Generalized	6.0
Other	4.4
Duration of Pain	
0-3 months	8.8%
3-6 months	15.8
6-12 months	18.7
>1 year	16.4
> 2 years	17.5
> 3 years	22.8

Table 2
Organization of the Six Hierarchical Regression Models Conducted in Assessing if Earlier Family Variables are Predictive of Later Child Health-Related Quality of Life (HRQOL)

Step	Predictors	Dependent Variable
1	child age child gender	self-reported child HRQOL at 1-month
2	pain intensity at intake pain duration at intake pain frequency at intake	
3	self-reported mother HRQOL at intake	
1	same variables	self-reported child HRQOL at 1-month
2	same variables	
3	mother reported family functioning at intake	
1	same variables	self-reported child HRQOL at 3-months
2	same variables	
3	self reported mother HRQOL at intake	
1	same variables	self-reported child HRQOL at 3-months
2	same variables	
3	Mother reported family functioning at intake	

Table 2 (continued)

Organization of the Six Hierarchical Regression Models Conducted in Assessing if Earlier Family Variables are Predictive of Later Child Health-Related Quality of Life (HRQOL)

Step	Predictors	Dependent Variable
1	same variables	self-reported child HRQOL at 3-months
2	same variables	
3	self-reported mother HRQOL at 1-month	
1	same variables	self-reported child HRQOL at 3-months
2	same variables	
3	mother reported family functioning at 1-month	

Table 3
Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) Scores of Participants in Dissertation Study (N=192)

Scale	Intake *M (SD)* n	1-Month *M (SD)* n	3-Month *M (SD)* n	12-Month *M (SD)* n
PedsQL™				
Total	58.9 (17.2) 187	62.9 (18.7) 169	66.7 (19.3) 123	71.4 (15.7) 56
FIM-Mother report				
PHRQOL	69.7 (21.3) 180	72.3 (22.8) 170	76.2 (21.4) 122	82.0 (18.6) 60
Family Functioning	67.1 (22.2) 180	70.0 (23.9) 170	72.6 (25.4) 123	77.7 (23.1) 58
FIM-Father report				
PHRQOL	77.2 (20.3) 91	77.4 (21.4) 107	82.5 (15.8) 66	90.6 (12.8) 36
Family Functioning	69.3 (22.0) 90	70.0 (24.5) 107	73.8 (18.8) 65	81.3 (20.0) 36

Table 4
Cronbach Alpha scores of Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) Scores (N=192)

Scale (number of items)		Intake	1-Month	3-month	12-Month
PedsQL™					
	Total (23)	.903	.930	.941	.941
FIM-Mother report					
	PHRQOL (20)	.956	.969	.967	.964
	Family Functioning (8)	.920	.942	.951	.961
FIM-Father report					
	PHRQOL (20)	.959	.970	.955	.960
	Family Functioning (8)	.920	.962	.921	.957

Table 5
Comparison of Intake Scores on Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) by Inclusion Status in Dissertation Study (N=914)

	In study		Out of Study			
Scale	n	*M(SD)*	*n*	*M (SD)*	*t(df)*	*p*
PedsQL™						
Total	187	58.9 (17.2)	549	59.1 (17.5)	.13 (734)	.895
FIM-Mother report						
PHRQOL	180	69.7 (21.3)	498	70.5 (20,9)	.45 (676)	.656
Family Functioning	180	67.1 (22.2)	496	67.5 (22.9)	.21 (674)	.835
FIM-Father report						
PHRQOL	91	77.2 (20.3)	239	77.6 (18.1)	.18 (328)	.861
Family Functioning	90	69.3 (22.0)	239	70.7 (22.7)	.50 (327)	.619

Table 6
Comparisons of Pain Clinic Visits of Participants in Longitudinal Study by Inclusion in Dissertation Study (N=454)

	In Study (n=192)	Out of Study (n=262)		
Type of Visit	*M(SD)*	*M (SD)*	*t(df)*	*p*
Medical	1.53 (1.89)	0.88 (1.63)	3.94 (452)	<.001
Psychotherapy	1.28 (2.84)	0.85 (2.12)	1.83 (452)	.068
Combined	1.97 (1.33)	1.61 (1.11)	3.12 (452)	.002
Total	4.78 (4.48)	3.34 (3.45)	3.86 (452)	<.001

Table 7
One-way Analysis of Variance of Medical Pain Clinic Visits and Intake Scores on Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) of Participants in Longitudinal Study (N= 454)

Scale	0 visits *M* (*SD*) *n*	1 visit *M* (*SD*) *n*	2 visits *M* (*SD*) *n*	3 visits *M* (*SD*) *n*	4+ visits *M* (*SD*) *n*	*F (df1, df2)*	*p*	*ES* (η^2)
PedsQL™ Total	60.1 (17.1) 202	57.6 (17.2) 95	61.8 (14.5) 44	54.3 (15.7) 24	58.3 (19.2) 44	1.14 (4, 404)	.334	.011
FIM-Mother report HRQOL	69.1 (21.8) 194	71.7 (20.5) 86	72.4 (18.6) 41	68.8 (21.9) 20	71.2 (20.2) 39	0.40 (4, 375)	.807	.004
FIM-Mother report Family Functioning	67.0 (23.2) 193	68.0 (22.7) 86	67.7 (20.5) 41	61.4 (20.3) 20	70.5 (23.7) 40	0.57 (4, 375)	.687	.006
FIM-Father report HRQOL	77.4 (19.6) 91	72.0 (17.7) 42	81.2 (17.6) 18	77.0 (18.8) 14	78.7 (15.6) 26	1.04 (4, 186)	.387	.022
FIM-Father report Family Functioning	71.8 (23.2) 92	62.9 (22.1) 42	68.8 (24.4) 18	64.3 (23.8) 14	71.4 (21.0) 25	1.32 (4, 186)	.265	.028

Table 8
One-way Analysis of Variance of Psychotherapy Pain Clinic Visits and Intake Scores on Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) of Participants in Longitudinal Study (N= 454)

Scale	0 visits *M* (*SD*) *n*	1 visit *M* (*SD*) *n*	2 visits *M* (*SD*) *n*	3 visits *M* (*SD*) *n*	4+ visits *M* (*SD*) *n*	*F (df1, df2)*	*p*	*ES* (η^2)
PedsQL™ Total	59.3 (17.0) 287	60.5 (17.1) 42	67.2 (15.7) 20	57.2 (20.0) 19	54.0 (15.3) 41	2.23 (4, 404)	.066	.022
FIM-Mother report HRQOL	70.7 (21.6) 259	69.7 (20.4) 44	70.3 (17.3) 19	66.9 (24.5) 18	69.3 (17.9) 40	0.17 (4, 375)	.955	.002
FIM-Mother report Family Functioning	67.2 (24.1) 259	68.3 (22.0) 44)	67.6 (20.2) 19	72.2 (22.2) 18	65.2 (13.8) 40	0.31 (4, 375)	.870	.003
FIM-Father report HRQOL	76.6 (19.3) 126	79.9 (13.2) 24	76.6 (12.8) 11	71.5 (24.4) 10	75.9 (19.1) 20	0.39 (4, 186)	.818	.008
FIM-Father report Family Functioning	69.2 (24.1) 127	69.7 (21.7) 24	62.5 (19.9) 11	69.8 (27.9) 9	69.7 (16.4) 20	0.23 (4, 186)	.921	.004

Table 9
One-way Analysis of Variance of Combined Pain Clinic Visits and Intake Scores on Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) of Participants in Longitudinal Study (N= 454)

Scale	1 visit *M* (*SD*) *n*	2 visits *M* (*SD*) *n*	3 visits *M* (*SD*) *n*	4+ visits *M* (*SD*) *n*	*F (df1, df2)*	*p*	*ES* (η^2)
PedsQL™ Total	60.4 (17.4) 240	58.1 (16.6) 93	57.4 (16.8) 41	55.5 (16.3) 35	1.25 (3, 405)	.293	.009
FIM-Mother report HRQOL	70.4 (22.0) 222	70.3 (19.5) 85	69.2 (20.4) 39	69.7 (19.0) 34	0.05 (3, 376)	.987	<.001
FIM-Mother report Family Functioning	68.2 (23.5) 222	63.9 (22.7) 86	69.7 (21.4) 38	68.4 (18.0) 34	0.93 (3, 376)	.424	.007
FIM-Father report HRQOL	77.5 (18.9) 105	74.5 (18.9) 44	77.2 (21.0) 22	76.9 (12.5) 20	0.27 (3, 187)	.847	.004
FIM-Father report Family Functioning	70.1 (23.8) 105	67.0 (21.8) 44	65.2 (25.8) 22	71.1 (17.8) 20	0.44 (3, 187)	.723	.007

Table 10
One-way Analysis of Variance of Total Pain Clinic Visits and Intake Scores on Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) of Participants in Longitudinal Study (N= 454)

Scale	1 visit *M* (*SD*) *n*	2 visits *M* (*SD*) *n*	3 visits *M* (*SD*) *n*	4 visits *M* (*SD*) *n*	5+ visits *M* (*SD*) *n*	*F (df1, df2)*	*p*	*ES* (η^2)
PedsQL™ Total	61.5 (16.3) 104	57.6 (18.1) 91	60.7 (15.0) 54	60.0 (16.4) 37	57.5 (17.9) 123	1.09 (4, 404)	.359	.011
FIM-Mother report HRQOL	70.7 (23.1) 96	69.0 (21.3) 86	71.6 (18.1) 50	73.7 (21.1) 32	69.3 (20.2) 116	0.42 (4, 375)	.795	.004
FIM-Mother report Family Functioning	67.6 (25.0) 96	66.5 (23.0) 86	66.5 (21.5) 49	68.2 (24.4) 32	68.1 (20.6) 117	0.09 (4, 375)	.985	.001
FIM-Father report HRQOL	78.1 (20.0) 42	76.5 (19.5) 41	79.3 (14.6) 22	76.0 (19.0) 18	75.3 (18.3) 68	0.27 (4, 186)	.898	.006
FIM-Father report Family Functioning	73.8 (24.9) 43	68.0 (21.9) 41	66.6 (22.3) 23	65.6 (28.3) 18	68.1 (21.1) 66	0.66 (4, 186)	.618	.014

Table 11
Repeated Measures ANOVA on Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) Scores of Participants in Dissertation Study Across Intake, 1-Month and 3-Months Time Waves (N=192)

Scale		n	Intake *M* (*SD*)	1-month *M* (*SD*)	3-month *M* (*SD*)	*F* (*df1,df2*)	*p*	*ES* (η_p^2)
PedsQL™								
	Total[a]	93	59.0 (16.3)	62.7 (18.1)	65.8 (18.6)	9.97 (2,184)[x]	<.001	.167
FIM-mother report								
	Parent HRQOL[b]	89	71.8 (18.9)	73.0 (22.7)	74.5 (22.1)	1.15 (2,176)[x]	.320	.013
	Family Functioning[b]	90	68.2 (21.5)	70.0 (23.4)	71.9 (26.4)	1.61 (1.82, 162.34)[y]	.205	.027
FIM-father report								
	Parent HRQOL[c]	39	76.0 (19.5)	77.2 (19.8)	83.2 (17.2)	3.78 (1.49, 56.51)[y]	.041	.090
	Family Functioning[b]	38	68.8 (22.1)	71.5 (21.9)	74.3 (19.9)	1.55 (2,74)[x]	.219	.040

[a] Intake scores significantly different from 3-month scores, after Bonferroni correction.
[b] No significantly different scores, after Bonferroni correction.
[c] One-month score significantly different from 3-month score, after Bonferroni correction.

[x]Sphericity assumed as Mauchly's test of sphericity non-significant.
[y] Sphericity not assumed as Mauchly's test of sphericity significant. Greenhouse-Geisser correction displayed.

Table 12
Hierarchical Regression Models Predicting One-Month Pediatric Quality of Life Inventory (PedsQL™) Scores Using Intake Family Impact Module (FIM) Scores

		Individual predictors			Model			
Step	Predictors	*B*	*t*	*p*	*F (df1, df2)*	R^2	p_Δ	f^2_Δ
Step 1					2.70 (2, 144)	.036	.071	.037
	Gender	-.189	-2.31	.022				
	Age	.024	0.30	.765				
Step 2					4.14 (5, 141)	.128	.003	.106
	Pain intensity	-.255	-3.17	.002				
	Pain duration	-.093	-1.11	.267				
	Pain frequency	-.142	-1.61	.109				
Step 3					7.30 (6, 140)	.238	<.001	.144
	FIM-Mother HRQOL	.352	4.50	<.001				
Step 1					2.70 (2, 144)	.036	.071	.037
	Gender	-.189	-2.31	.022				
	Age	.024	0.30	.765				
Step 2					4.41 (5, 141)	.128	.003	.106
	Pain intensity	-.255	-3.17	.002				
	Pain duration	-.093	-1.11	.267				
	Pain frequency	-.142	-1.61	.109				
Step 3					6.57 (6, 140)	.220	<.001	.117
	FIM-Mother Family Functioning	.312	4.05	<.001				

Table 13
Hierarchical Regression Models Predicting Three-Month Pediatric Quality of Life Inventory (PedsQL™) Scores Using Intake Family Impact Module (FIM) Scores

		Individual predictors			Model			
Step	Predictors	*B*	*t*	*p*	*F (df1, df2)*	R^2	p_Δ	f^2_Δ
Step 1					0.95 (2, 98)	.019	.390	.019
	Gender	-.091	-.907	.367				
	Age	.106	1.06	.294				
Step 2					2.36 (5, 95)	.110	.025	.102
	Pain intensity	-.244	-2.47	.015				
	Pain duration	.030	.289	.773				
	Pain frequency	-.141	-1.30	.197				
Step 3					4.54 (6, 94)	.225	<.001	.147
	FIM-Mother HRQOL	.358	3.73	<.001				
Step 1					0.95 (2, 98)	.019	.390	.019
	Gender	-.091	-.907	.367				
	Age	.106	1.06	.294				
Step 2					2.36 (5, 95)	.110	.025	.102
	Pain intensity	-.244	-2.47	.015				
	Pain duration	.030	.289	.773				
	Pain frequency	-.141	-1.30	.197				
Step 3					4.00 (6, 94)	.203	.001	.117
	FIM-Mother Family Functioning	.314	3.31	.001				

Table 14
Hierarchical Regression Models Predicting Three-Month Pediatric Quality of Life Inventory (PedsQL™) Scores Using One-Month Family Impact Module (FIM) Scores

		Individual predictors			Model			
Step	Predictors	*B*	*t*	*p*	*F (df1, df2)*	R^2	p_Δ	f^2_Δ
Step 1					0.90 (2, 93)	.019	.409	.019
	Gender	-.091	-0.88	.379				
	Age	.106	1.03	.306				
Step 2					2.23 (5, 90)	.110	.031	.102
	Pain intensity	-.244	-2.40	.018				
	Pain duration	.030	0.28	.779				
	Pain frequency	-.141	-1.27	.209				
Step 3					4.31 (6, 89)	.225	<.001	.148
	FIM-Mother HRQOL	.348	3.63	<.001				
Step 1					0.90 (2, 93)	.019	.409	.019
	Gender	-.091	-0.88	.379				
	Age	.106	1.03	.306				
Step 2					2.23 (5, 90)	.110	.031	.102
	Pain intensity	-.244	-2.40	.018				
	Pain duration	.030	0.28	.779				
	Pain frequency	-.141	-1.27	.209				
Step 3					5.18 (6, 89)	.259	<.001	.200
	FIM-Mother Family Functioning	.406	4.22	<.001				

Table 15
Pearson Zero-Order Correlations Between One-Year Pediatric Quality of Life Inventory (PedsQL™) and Family Impact Module (FIM) Scores

Time Wave	Scale	*n*	*r*	*p*
Intake				
	FIM-Mother HRQOOL	48	.174	.238
	FIM-Mother Family Functioning	48	.169	.250
	FIM-Father HRQOL	35	.174	.319
	FIM-Father Family Functioning	35	.267	.122
1-month				
	FIM-Mother HRQOL	50	.176	.223
	FIM-Mother Family Functioning	50	.136	.347
	FIM-Father HRQOL	34	.019	.914
	FIM-Father Family Functioning	33	.277	.118
3-month				
	FIM-Mother HRQOL	51	.240	.089
	FIM-Family Functioning	51	.148	.301
	FIM-Father HRQOL	29	.295	.121
	FIM-Father Family Functioning	28	.436	.020

Table 16
Summary of Hypothesis Testing

Hypothesis	Result	Summary
1. Child HRQOL, Parental HRQOL and family functioning were expected to increase in first three months of treatment.	Partially supported	Child HRQOL and father HRQOL significantly increased over time (large and medium size, respectively). Mother HRQOL, mother HRQOL, mother-reported family functioning and father-reported family functioning did not significantly improve over time.
2. Earlier family variables were expected to predict later child HRQOL (i.e., intake --> 1-month, intake --> 3-months, 1-month--> 3-month)	Supported	In series of six hierarchical regression models, mother HRQOL and family functioning at intake and one month were predictive of child HRQOL at one month and three months. *
3. One-month family variables were expected to be more predictive of child HRQOL at three months than intake family variables.	Partially supported	Family functioning at one-month (medium effect size) more predictive than family functioning at intake (small effect size). Effect sizes of mother HRQOL at intake and one month nearly identical (medium effect size).**

* Same results observed when father-reported data was used with mother-reported data.
** Intake family variables found to be more predictive than one-month variables in models including father-reported data.

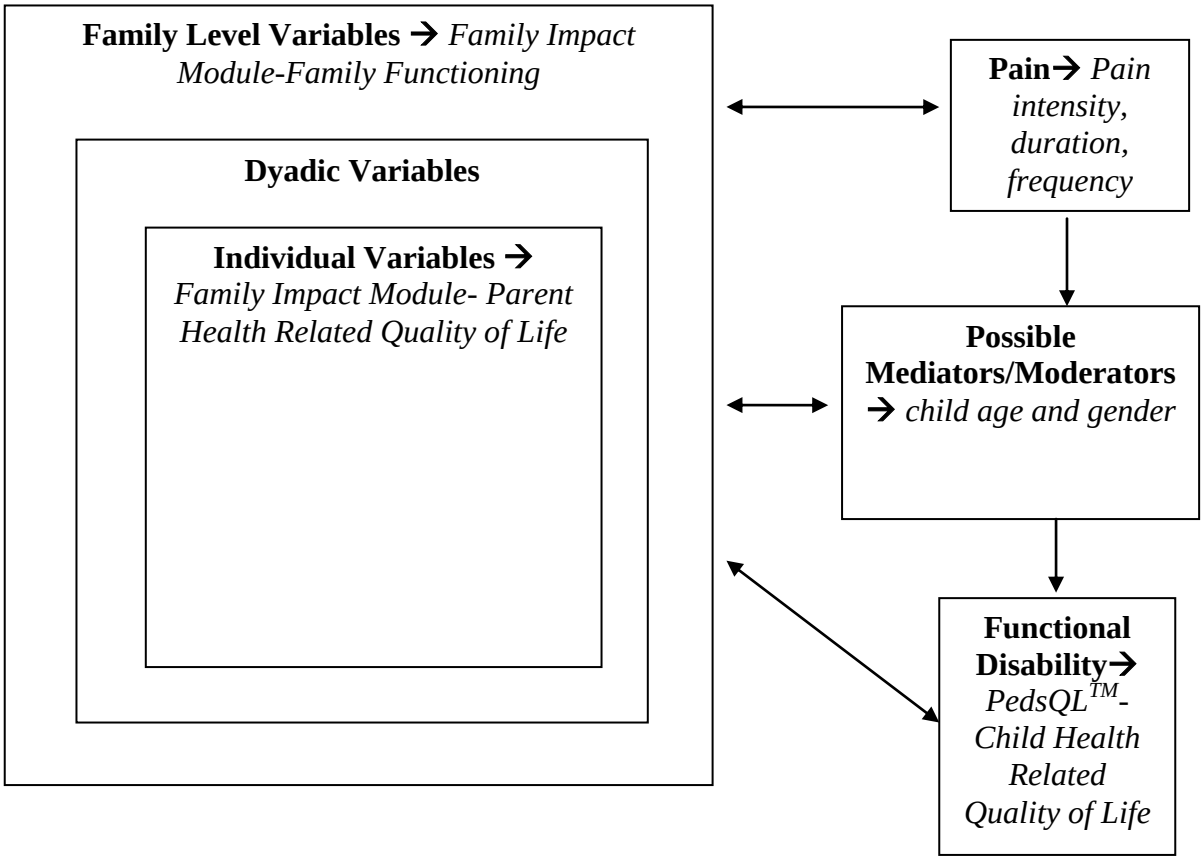

Figure 1. Placing Current Study Within Palermo & Chambers (2005) Integrate Model of Parent and Family Factors in Pediatric Chronic Pain and Associated Disability

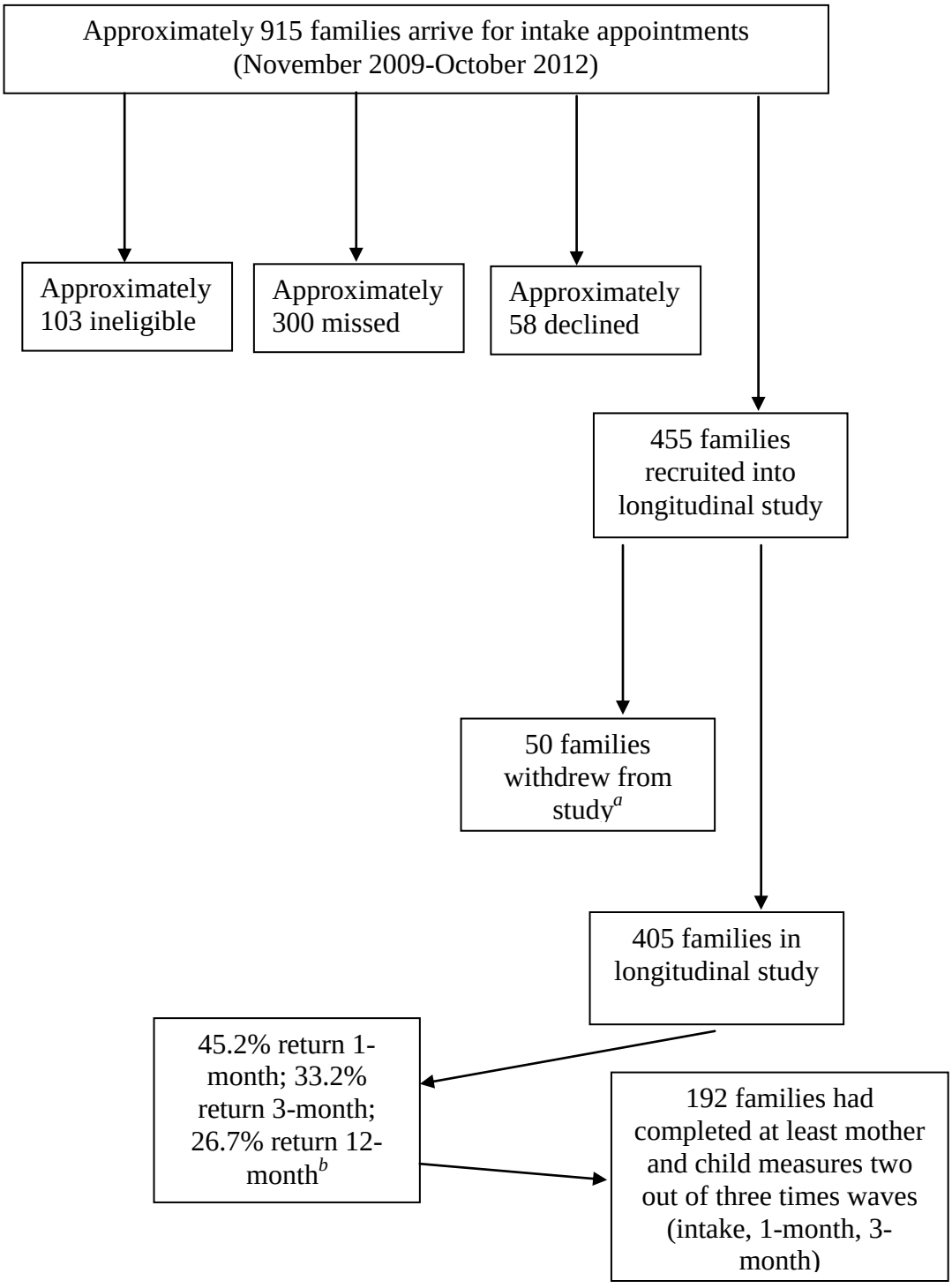

Figure 2. Flow of Participation into Present Study
[a] Some participants withdrew from study after completing some follow-up measures.
[b] 92% of measures returned were completed by both mother and child.

Appendix: Tables of Auxiliary Analyses

Appendix A1

Hierarchical Regression Models Predicting One-Month Pediatric Quality of Life Inventory (PedsQL™) Scores Using Intake Family Impact Module (FIM) Scores, Including Fathers' Data

		Individual predictors			Model			
Step	Predictors	*B*	*t*	*p*	*F (df1, df2)*	R^2	p_Δ	f^2_Δ
Step 1					1.44 (2, 77)	.036	.242	.037
	Gender	-.189	-1.69	.095				
	Age	.024	.219	.827				
Step 2					2.17 (5, 74)	.128	.058	.106
	Pain intensity	-.255	-2.29	.025				
	Pain duration	-.093	-.807	.422				
	Pain frequency	-.142	-1.17	.247				
Step 3					4.30 (7, 72)	.295	<.001	.235
	FIM-Mother HRQOL	.193	1.56	.123				
	FIM-Father HRQOL	.305	2.40	.019				
Step 1					1.43 (2, 76)	.036	.247	.037
	Gender	-.189	-1.68	.097				
	Age	.024	0.22	.829				
Step 2					2.15 (5, 73)	.128	.061	.106
	Pain intensity	-.255	-2.28	.026				
	Pain duration	-.093	-0.80	.425				
	Pain frequency	-.142	-1.16	.250				
Step 3					3.70 (7, 71)	.267	.002	.188
	FIM-Mother Family Functioning	.176	1.44	.154				
	FIM-Father HRQOL	.271	2.14	.035				

Appendix A2

Hierarchical Regression Models Predicting Three-Month Pediatric Quality of Life Inventory (PedsQL™) Scores Using Intake Family Impact Module (FIM) Scores, Including Fathers' Data

		Individual predictors			Model			
Step	Predictors	*B*	*t*	*p*	*F (df1, df2)*	R^2	p_Δ	f^2_Δ
Step 1					0.51 (2, 52)	.019	.607	.019
	Gender	-.091	-0.66	.512				
	Age	.106	0.77	.445				
Step 2					1.22 (5, 49)	.110	.184	.102
	Pain intensity	-.244	-1.77	.082				
	Pain duration	.030	0.21	.836				
	Pain frequency	-.141	-0.93	.355				
Step 3					3.76 (7, 47)	.359	<.001	.387
	FIM-Mother HRQOL	.113	0.78	.441				
	FIM-Father HRQOL	.472	3.14	.003				
Step 1					0.51 (2, 52)	.019	.607	.019
	Gender	-.091	-0.66	.512				
	Age	.106	0.77	.445				
Step 2					1.22 (5, 49)	.110	.184	.102
	Pain intensity	-.244	-1.77	.082				
	Pain duration	.030	0.21	.836				
	Pain frequency	-.141	-0.93	.355				
Step 3					4.60 (7, 47)	.407	<.001	.500
	FIM-Mother Family Functioning	.033	.246	.807				
	FIM-Father Family Functioning	.561	4.01	<.001				

Appendix A3

Hierarchical Regression Models Predicting Three-Month Pediatric Quality of Life Inventory (PedsQL™) Scores Using One-Month Family Impact Module (FIM) Scores, Including Fathers' Data

		Individual predictors			Model			
Step	Predictors	*B*	*t*	*p*	*F (df1, df2)*	R^2	p_Δ	f^2_Δ
Step 1					0.59 (2, 61)	.019	.556	.019
	Gender	-.091	-0.72	.477				
	Age	.106	0.83	.408				
Step 2					1.44 (5, 58)	.110	.126	.102
	Pain intensity	-.244	-1.93	.059				
	Pain duration	.030	0.23	.822				
	Pain frequency	-.141	-1.02	.314				
Step 3					2.86 (7, 56)	.263	.005	.208
	FIM-Mother HRQOL	.186	1.23	.224				
	FIM-Father HRQOL	.258	1.71	.093				
Step 1					0.59 (2, 61)	.019	.556	.019
	Gender	-.091	-0.72	.477				
	Age	.106	0.83	.408				
Step 2					1.44 (5, 58)	.110	.126	.102
	Pain intensity	-.244	-1.93	.059				
	Pain duration	.030	0.23	.822				
	Pain frequency	-.141	-1.02	.314				
Step 3					4.33 (7, 56)	.351	<.001	.371
	FIM-Mother Family Functioning	.088	0.55	.584				
	FIM-Father Functioning	.441	2.83	.007				

Appendix A4

Correlations Between One-Month Pediatric Quality of Life Inventory (PedsQL™) Scores and Predictors at Intake in Last Step of Hierarchical Regression Model Using Fathers' Data

Predictor	Zero-order	Partial	Semi-partial
Child gender	-.189	-.177	-.151
Child age	.021	-.067	-.057
Pain intensity	-.290	-.134	-.114
Pain duration	-.032	-.181	-.155
Pain frequency	-.198	-.136	-.115
FIM-Mother HRQOL	.387	.181	.154
FIM-Father HRQOL	.408	.272	.237
Child gender	-.189	-.161	-.140
Child age	.021	-.024	-.020
Pain intensity	-.290	-.148	-.128
Pain duration	-.032	-.149	-.129
Pain frequency	-.198	-.156	-.135
FIM-Mother Family Functioning	.348	.168	.146
FIM-Father Family Functioning	.384	.247	.218

Appendix A5

Correlations Between Three-Month Pediatric Quality of Life Inventory (PedsQL™) Scores and Predictors at Intake in Last Step of Hierarchical Regression Model Using Fathers' Data

Predictor	Zero-order	Partial	Semi-partial
Child gender	-.089	-.079	-.064
Child age	.104	-.007	-.006
Pain intensity	-.280	-.106	-.085
Pain duration	.092	-.082	-.066
Pain frequency	-.200	-.140	-.113
FIM-Mother HRQOL	.416	.113	.091
FIM-Father HRQOL	.556	.416	.367
Child gender	-.089	-.081	-.063
Child age	.104	.027	.021
Pain intensity	-.280	-.090	-.069
Pain duration	.092	-.041	-.032
Pain frequency	-.200	-.181	-.142
FIM-Mother Family Functioning	.365	.036	.028
FIM-Father Family Functioning	.601	.505	.451

Appendix A6

Correlations Between Three-Month Pediatric Quality of Life Inventory (PedsQL™) Scores and Predictors at One-Month in Last Step of Hierarchical Regression Model Using Fathers' Data

Predictor	Zero-order	Partial	Semi-partial
Child gender	-.089	.037	.031
Child age	.104	.135	.117
Pain intensity	-.280	-.230	-.203
Pain duration	.092	<.001	<.001
Pain frequency	-.200	-.140	-.122
FIM-Mother HRQOL	.396	.162	.141
FIM-Father HRQOL	.359	.223	.196
Child gender	-.089	.047	.038
Child age	.104	.157	.128
Pain intensity	-.280	-.236	-.196
Pain duration	.092	.047	.038
Pain frequency	-.200	-.081	-.065
FIM-Mother Family Functioning	.464	.073	.059
FIM-Father Family Functioning	.502	.353	.304

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EDUCATION

2011-present Doctoral student in APA Approved Clinical Psychology Program, University of Wisconsin-Milwaukee
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2011 Phi Beta Kappa, University of Wisconsin-Milwaukee

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2010 University of Wisconsin-Milwaukee Graduate Student Travel Award

2009-2012 Advanced Opportunity Program Fellowship, University of Wisconsin-Milwaukee

2008-2010 Chancellor's Graduate Student Award, University of Wisconsin-Milwaukee

2005-2006 Honors Program, Department of Psychology, Northwestern University

2005 Benton J. Underwood Summer Research Fellowship, Northwestern University

2003 Fountiene A.C. Duda Endowed Scholarship for academic and extracurricular excellence, Northwestern University

PEER-REVIEWED PUBLICATIONS

Medrano, G.R., Berlin, K.S., & Davies, W.H. (in press). Utility of the PedsQL^{TM} FIM: Assessing the psychometric properties in a community sample. *Quality of Life Research.* doi: 10.1007/s11136-013-0422-9.

Gorodzinsky, A.Y., Davies, W.H., Tran, S.T., **Medrano, G.R.**, Bernacki, J.M., Burks, L.M., Anderson Khan, K., Hainsworth, K.R., & Weisman, S.J. (2013). Adolescents' perceptions of family dynamics when a sibling has chronic pain. Children's Health Care, 42(4).

Gorodzinsky, A.Y., Tran, S.T., **Medrano, G.R.**, Fleishman, K., Anderson Khan, K., Ladwig, R.J., & Weisman, S.J. (2012). Parents' initial perceptions of interdisciplinary treatment at a pediatric chronic pain clinic. *Pain Research and Treatment, 2012.* doi:10.1155/2012/791061.

MANUSCRIPTS IN PREPARATION

Medrano, G.R., Davies, W.H., Hainsworth, K.R., & Weisman, S.J. *Dyadic differences in the health-related quality of life of parents of children with chronic pain.* Manuscript in preparation.

Davies, W.H., Tran, S.T., & **Medrano, G.R.** *Effects of opt-in versus opt-out recruitment on external validity of survey research.* Manuscript in preparation.

Burks, L.M., Tran, S.T., & **Medrano, G.R.**, & Davies, W.H. *Parental perceptions on the right to request destruction of data after drop-out.* Manuscript in preparation.

PAPER PRESENTATIONS AT CONFERENCES

Medrano, G.R., Gallo, P.D., Hainsworth, K.R., Anderson Khan, K.J., Rusy, L.M., Davies, W.H., & Weisman, S.J. (2012, April). *Child and parent health-related quality of life in families receiving treatment for pediatric chronic pain.* Paper presentation at the 2012 Midwest Regional Conference in Pediatric Psychology, Milwaukee, WI.

Medrano, G.R., Davies, W.H., Anderson Khan, K.J., Varadarajan, J., Hainsworth, K.R., & Weisman, S.J. (2012, February). *Associations between fathers' health-related quality of life and functioning of children dealing with chronic pain.* Paper presentation at the 2012 Interdisciplinary Pediatric Behavioral Health Research Conference, Milwaukee, WI.

Medrano, G.R., Davies, W.H., Hainsworth, K.R., & Weisman, S.J. (2011, April). *Dyadic differences in health-related quality of life of parents of children with chronic pain.* Paper presented at the Association of Graduate Students in Psychology Research Symposium, Milwaukee, WI.

Majewski, A.J., **Medrano, G.R.**, Silverman, A.H., & Davies, W.H. (2011, February). *Reliability and validity of the family impact module in a community-recruited sample.* Paper presented at the 2011 Interdisciplinary Pediatric Behavioral Health Research Conference, Milwaukee, WI.

Gorodzinsky, A.Y., Davies, W.H., Heinze, S.T., Joseph, J.M., **Medrano, G.R.**, Elfman, J., Khan, K.A., Hainsworth, K.R., & Weisman, S.J. (2011, February). *Adolescents' perceptions of their familial relationships when a sibling has chronic pain.* Presented at the 2011 Interdisciplinary Pediatric Behavioral Health Research Conference, Milwaukee, WI.

POSTER PRESENTATIONS AT CONFERENCES

Tran, S. T., **Medrano, G. R.**, Anderson Khan, K., Ladwig, R. J., Weisman, S. J., Davies, W. H., & Hainsworth, K. R. (2013 April). Differential utility of pain catastrophizing by reporter for predicting later functioning in chronic pain. Poster presentation at the 2013 National Conference in Pediatric Psychology, New Orleans, LA.

Hainsworth, K.R., Simpson, P., Swartz, A., Tran, S.T., **Medrano, G.R.,** Mascarenhas, B., Weisman, S., & Liu, X.C. (2013, January). *Effects of yoga on gait performance in obese youth*. Poster presentation at the Orthopaedic Research Society 2013 Annual Meeting, San Antonio, TX.

Jastrowski-Mano, K.E., Hainsworth, K.R., **Medrano, G.R.,** Tran, S.T., & Weisman, S. (2012, August). *Validation of the pediatric symptom checklist in a chronic pain sample.* Poster presentation at the 14th World Congress on Pain, Milan, Italy.

Medrano, G.R., Berlin, K.S., & Davies, W.H. (2012, August). *Reliability and validity of the PedsQL™ family impact module in a non-clinical sample.* Poster presentation at the 2012 Annual Convention of the American Psychological Association, Orlando, FL.

Tran, S.T., Davies, W.H., **Medrano, G.R.**, & Burks, L.M. (2012, August). *The relationship between provider satisfaction and likelihood of research participation.* Poster presentation at the 2012 Annual Convention of the American Psychological Association, Orlando, FL.

Burks, L.M., Tran, S.T., **Medrano, G.R.**, & Davies, W.H. (2012, April). *Parent perceptions on the right to request destruction of data after study drop-out.* Poster presentation at the 2012 Midwest Regional Conference in Pediatric Psychology, Milwaukee, WI.

Bernacki, J. M., **Medrano, G. R.**, Hainsworth, K. R., Khan, K. A., Ladwig, R. J., Davies, W. H., & Weisman, S. J. (2012, April). *Readiness to change in pediatric chronic pain: Predicting treatment outcomes*. Poster presentation at the 2012 Midwest Regional Conference in Pediatric Psychology, Milwaukee, WI.

Gorodzinsky, A.Y., Davies, W.H., **Medrano, G.R.**, Heinze, S.T., Joseph, J.M., Burks, L.M., Feller, T.M., Anderson Khan, K., Ladwig, R.J., Hainsworth, K.R. & Weisman, S.J. (2011, October). *Changes in familial relationships related to pediatric chronic pain: Perspectives from adolescent patients and their siblings*. Poster presented at the International Forum on Pediatric Pain in White Point, Nova Scotia, Canada.

Joseph, J.M., **Medrano, G.R.**, Hainsworth, K.R., Khan, K.A., Ladwig, R.J., Davies, W.H., & Weisman, S.J. (2011, April). *Readiness to change in adolescents presenting with complex chronic pain.* Poster presented at the 2011 National Conference in Pediatric Psychology, San Antonio, TX.

Heinze, S.T., Majewski, A.M., **Medrano, G.R.**, & Davies, W.H. (2011, April). *Parent intended participation and attitudes toward opt-in and opt-out recruitment methods.* Poster presented at the 2011 National Conference in Pediatric Psychology, San Antonio, TX.

Feller, T.M., Gorodzinsky A.Y., **Medrano, G.R.**, Burks, L.M., Heinze, S.T., Joseph, J.M., & Davies, W.H. (2011, April). *Chronic pain and how it changes family relationships.* Poster presentation at the Association of Graduate Students in Psychology Research Symposium, Milwaukee, WI.

Feller, T.M., Gorodzinsky A.Y., **Medrano, G.R.**, Burks, L.M., Heinze, S.T., Joseph, J.M., & Davies, W.H. (2011, March). *Chronic pain and how it changes family*

relationships. Poster presentation at the Wisconsin Psychological Association Conference, Middleton, WI.

Gorodzinsky, A.Y., Heinze, S.T., Joseph, J.M., **Medrano, G.R.**, Elftman, J., Khan, K.A.,Hainsworth, K.R., Weisman, S.J., & Davies, W.H. (2010, October). *Adolescents' perceptions of their relationship to a sibling with chronic pain.* Poster presented at the 2010 Kansas Conference in Clinical Child and Adolescent Psychology, Lawrence, KS.

Medrano, G.R. & Davies, W.H. (2010, August). *Dyadic patterns of parental perceptions of health-related quality of life*. Poster presented at the 2010 American Psychological Association Annual Convention, San Diego, CA.

Medrano, G.R., Heinze, S.T., Hainsworth, K.R., & Weisman, S.J. (2010, April). *Pediatric chronic pain and differences in parental health-related quality of life*. Poster presented at the 2010 Annual Meeting & Scientific Sessions of the Society of Behavioral Medicine, Seattle, WA and at 2011 Interdisciplinary Pediatric Behavioral Health Research Conference, Milwaukee, WI .

Majewski, A.J., Neu, A.M., **Medrano, G.R.**, Holman, K.S., & Davies, W.H. (2010, March). *Parents' overall quality of life is negatively affected by having a child with feeding problems*. Poster presented at the 2010 Wisconsin Psychological Association Annual Convention, Middleton, WI.

Heinze, S.T., **Medrano, G.R.**, Gorodizinsky, A.Y., Hainsworth, K.R., & Weisman, S.J. (2010 April). *Applying the fear-avoidance model of chronic pain to a pediatric population.* Poster presented at the 2010 Annual Meeting & Scientific Sessions of the Society of Behavioral Medicine, Seattle, WA.

Czarnecki, M., Heinze, S.T., **Medrano, G.R.**, Salamon, K.S., Turner, H., & Wrona, S. (2010, February). *Optimal pain management: What does it mean to pediatric nurses?* Poster presented at the 2010 Interdisciplinary Pediatric Behavioral Health Research Conference, Milwaukee, WI.

Gorodzinsky, A.Y., Heinze, S.T., Joseph, J.M., **Medrano, G.R.**, Salamon, K.S., Khan, K.A., & Hainsworth, K.R. (2010, February). *Adolescents' perceptions of sibling relationships when their sibling has chronic pain*. Poster presented at the 2010 Interdisclinplinary Pediatric Behavioral Health Research Conference, Milwaukee, WI.

Heinze, S.T., **Medrano, G.R.**, Simon, K., Czarnecki, M., Turner, H., & Wrona, S. (2009, October). *Pediatric nurses' perceptions of optimal pain management across departments*. Poster presented at the 2009 Annual Meeting of The Society for Developmental and Behavioral Pediatrics.

Joseph, J. M., Gorodzinsky, A. Y., **Medrano, G. R.**, Drendel, A. L., & Davies, W. H. (2009, October). *How do parents make decisions about analgesic use? Examining the impact of gender and child age in a community sample*. Poster presented at the 2009 Annual Meeting of The Society for Developmental and Behavioral Pediatrics, Portland, OR.

Medrano, G.R., Heinze, S.T., Czarnecki, M., Simon, K., Turner, H., & Wrona, S. (2009, April). *Role of experience in nurses' perceptions of barriers to optimal pain management with pediatric patients*. Poster session presented at the Midwest Conference on Pediatric Psychology, Kansas City, MO.

Heinze, S.T., **Medrano, G.R.**, Simon, K., Czarnecki, M., Turner, H., & Wrona, S. (2009, April). *Perceptions of optimal pain management among nurses who work with pediatric patients*. Poster session presented at the Midwest Conference on Pediatric Psychology.

Medrano, G. R. (2006, June). *The effects of marital conflict on children's peer relationships: Differential effects in boys and girls*. Undergraduate thesis presented at the Northwestern University Annual Undergraduate Symposium and Psychology Departmental Symposium, Evanston, IL.

CLINICAL EXPERIENCE

September 2012-present — Student therapy supervisor, University of Wisconsin-Milwaukee

Provide individual supervision of novice graduate student therapists who are providing individual therapy. Co-lead team meetings consisting of novice graduate student therapists, other clinical psychology graduate students, and faculty. Under the supervision of Jonathan Kanter, Ph.D. and Christopher Martell, Ph.D.

June 2012-present — Practicum student, individual and family therapy, Sixteenth Street Community Health Clinic

Provide individual and family therapy to adolescent and adult clients. A majority of the clientele is Spanish-speaking only and low socioeconomic status, and present with symptoms of depression, anxiety and trauma-related stress. Clients are usually seen on a weekly basis, and are generally provided with cognitive-behavioral therapy, along with dialectical behavioral therapy skills. Therapy is administered under the supervision of Paul West, Ph.D.

August 2011-June 2012	Practicum student, Intensive Outpatient Program, Aurora Psychiatric Hospital Provide psychoeducation on dialectical behavioral therapy skills and co-lead group therapy of 8-12 clients exhibiting severe depression, suicidal ideation, severe anxiety, bipolar disorder, and other assorted disorders and symptoms. Group met three times a week, focusing on behavioral activation, and therapy was under the supervision of Greg Schramka, PsyD.
May 2010-present	Psychology Clinic student therapist, University of Wisconsin-Milwaukee Conduct therapy with adults using cognitive-behavior and behavioral therapeutic techniques under the supervision of Vincent J. Adesso, Ph.D., Jonathan W. Kanter, Ph.D. & Robyn C. Ridley, Ph.D.
June 2009-June 2010	Psychology Clinic student assessor, University of Wisconsin-Milwaukee Completed comprehensive assessments of four adults and two children, including conducting clinical interviews, administering battery of tests, writing integrative reports, and providing feedback to client and/or school officials in IEP meetings. Under the supervision of Bonita Klein-Tasman, Ph.D. and David C. Osmon, Ph.D., ABPP.
June 2009-August 2010	Volunteer, Sixteenth Street Community Health Center, Milwaukee, WI Observed and led diabetes support group, as well as observed therapy sessions and conducted intake interviews, all in Spanish. Under the supervision of Gabriela Dieguez, MSW, LCSW

Tests administered

Achievement Motivation Profile
Anxiety Disorders Interview Schedule (ADSIS-IV)
B-test
Behavior Assessment System for Children (BASC-2)
Brief Test of Attention
California Verbal Learning Test (CVLT-2)

Children's Memory Scale (CMS)
Clinical Evaluation of Language Fundamentals (CELF-4)
Cognitive Assessment System (CAS)
d2 Test of Attention
Differential Ability Scales (DAS-2)
Delis-Kaplan Executive Function System (D-KEFS)
Gordon Diagnostic System
Meta-Cognitions Questionnaire
Minnesota Multiphasic Personality Inventory (MMPI-II)
Nelson-Denny Reading Test
NEO Personality Inventory-Revised
Neuropsychological Assessment (NEPSY-2)
Neuropsychological Assessment Battery (NAB)
Personality Assessment Inventory (PAI)
Rapid Automatized Naming and Rapid Alternating Stimulus Tests
Raven's Progressive Matrices
Roberts-2
Shipley Institute of Living Scale
Stroop Color and Word Test
Structured Clinical Interview for DSM-IV (SCID I & II)
Test of Word Reading Efficiency (TOWRE)
Wechsler Adult Intelligence Scale (WAIS-III)
Wechsler Individual Achievement Test (WIAT-II (child and adult) and WIAT-III (adult))
Wechsler Intelligence Scale for Children (WISC-IV)
Wide Range Achievement Test (WRAT-III)
Woodcock-Johnson III Tests of Cognitive Abilities & Achievement (WJ-III (child and adult)

RESEARCH EXPERIENCE

2009-present — Project assistant, University of Wisconsin-Milwaukee and Sixteenth Street Community Health Center, Milwaukee, WI
Co-develop adherence coding manual and code sessions (in Spanish) accordingly in an NIMH-funded intervention study. Also administered measures in Spanish at the clinic. Under the supervision of Jonathan W. Kanter, Ph.D.

2008-present — Graduate student researcher, University of Wisconsin-Milwaukee, Child Stress and Coping Lab
Assist in the management of online database, run participants, and was a coder of three qualitative projects.

2008-present Graduate student researcher, Children's Hospital of Wisconsin, Chronic Pain Clinic, Wauwatosa, WI

Manage the collection of outcomes data, including recruiting participants, assembling questionnaire packets and managing the database. Also assisted in the management of intake data, along with creating IRB submissions (i.e., new projects, continuing reviews, terminations). Under the supervision of Keri R. Hainsworth, Ph.D.

2004-2006 Undergraduate research assistant, Northwestern University, Evanston, IL

Managed data collection and entry, assisted in recruitment, trained new research assistants, coded emotional expressions and helped in the running of research participants through their laboratory visits. Under the supervision of C. Emily Durbin, Ph.D.

SERVICE

Leadership

2011-2012 President, Association of Graduate Students in Psychology, University of Wisconsin-Milwaukee

Led in the organization of the 2012 Graduate Student Research Symposium, including brining in keynote speaker Jeansok Kim, Ph.D. and organizing graduate student presentations.

2010-2011 Vice-President, Association of Graduate Students in Psychology, University of Wisconsin-Milwaukee

Aided in organizing the 2011 Graduate Student Research Symposium, including bringing in keynote speaker Larry Squire, Ph.D. and organizing graduate student presentations.

Manuscript Reviews

2012-present Quality of Life Research

Review completed independently: 1

2010-present Journal of Youth and Adolescence

Co-reviews completed with Debra Palmer, Ph.D.: 2

2008-present	Journal of Pediatric Psychology Co-reviews completed with Kristoffer Berlin, Ph.D.: 1 Co-reviews completed with Debra Palmer, Ph.D.: 3

Affiliations

2012-present	Association for Behavioral and Cognitive Therapies (student member)
2012-present	National Latina/o Psychological Association (student member)
2010	Society of Behavioral Medicine (student member)
2008-present	American Psychological Association (student affiliate)
2008-present	Society of Pediatric Psychology (student affiliate)

TEACHING EXPERIENCE

Spring 2013	Associate Lecturer, University of Wisconsin-Milwaukee, Personality Psychology (undergraduate). One hour and 40 minutes of weekly lecture with 300 students, along with supervising weekly discussion sections led by two teaching assistants.
Spring 2013	Teaching Assistant, University of Wisconsin-Milwaukee, Experimental Child Psychology (undergraduate). Online class with 60 students.
Fall 2012	Associate Lecturer, University of Wisconsin-Milwaukee, Personality Psychology (undergraduate). One hour and 40 minutes of weekly lecture with 300 students, along with supervising weekly discussion sections led by two teaching assistants.
Fall 2012	Teaching Assistant, University of Wisconsin-Milwaukee. Child Psychology (undergraduate). Online class with 100 students.
Spring 2012	Associate Lecturer, University of Wisconsin-Milwaukee, Introduction to Psychology (undergraduate).Two and a half hours of weekly lecture with 300 students.
Fall 2011	Associate Lecturer, University of Wisconsin-Milwaukee, Introduction to Psychology (undergraduate).Two and a half hours of weekly lecture with 300 students.
March 10, 2010	Guest Lecturer, University of Wisconsin-Milwaukee, Introduction to Psychology (undergraduate)
October 5, 2009	Guest Lecturer, University of Wisconsin-Milwaukee, Introduction to Psychology (undergraduate)

April 23, 2009	Guest Lecturer, University of Wisconsin-Milwaukee, Psychological Statistics (undergraduate)
Spring 2009	Teaching Assistant, University of Wisconsin-Milwaukee. Psychological Statistics (undergraduate). Three sections with an average class size of 20.
Fall 2008	Teaching Assistant, University of Wisconsin-Milwaukee. Personality Psychology (undergraduate). Four sections with an average class size of 20.
2006-2007	Math Teacher, Olney East High School, in Philadelphia, PA. Algebra I. Freshman course covering first-year algebra. Three sections with an average class size of 25.
2006-2007	Math Teacher, Olney East High School, in Philadelphia, PA. Intensive Math. Freshman course providing remedial math skills. Three sections with an average class size of 25.