

Adolescent Pain Catastrophizing Mediates the Relationship Between Protective Parental Responses to Pain and Disability Over Time

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Objective Examine whether the relation between protective parenting responses to pain and functional disability is mediated by pain catastrophizing in adolescents with chronic musculoskeletal pain and their parents over time. **Methods** Adolescents aged 11–18 years and their parents reported on parental protective responses to pain (PPRP), pain catastrophizing scale (PCS), and Functional Disability Inventory (FDI) before Time 1 (T1) and 2 months after Time 2 (T2) an initial interdisciplinary pain clinic evaluation. **Results** PCS was a significant mediator of the PPRP–FDI relationship at T1 and T2 for the adolescents and T2 for their parents. A decrease in PPRP over time was associated with T2 PCS, which in turn was associated with T2 FDI for adolescents and their parents. **Conclusion** Parental protectiveness is associated with disability indirectly through pain catastrophizing at the initial visit and follow-up. Decreases in parent protectiveness, potentially initiated through the initial evaluation, were related to lower levels of disability at follow-up through pain catastrophizing.

Key words adolescents; catastrophizing; disability; pain.

Chronic pain affects ~25–30% of children in the United States (Perquin et al., 2000; Zeltzer, Tsao, Bursch, & Myers, 2006). Chronic pain is generally defined as pain that persists for >3 months and interferes with one's functioning (Zeltzer et al., 2006). Pain-related disability is an assessment of the extent to which pain impairs functioning and has been well-researched in children and adolescents with chronic pain (Claar & Walker, 2006; Kashikar-Zuck et al., 2011; Long, Palermo, & Manees, 2008; Walker & Greene, 1991). Specifically, chronic pain has been associated with decrements in activity participation (Hunfeld et al., 2002; Logan, Simons, Stein, & Chastain, 2008; Roth-Isigkeit, Thyen, Stoven, Schwarzenberger, & Schmucker, 2005), school attendance (Logan et al., 2008; Roth-Isigkeit et al., 2005), and sleep quality

(Palermo & Chambers, 2005; Palermo, Toliver-Sokol, Fonareva, & Koh, 2007). Furthermore, pediatric chronic pain negatively impacts health-related quality of life (Connelly & Rapoff, 2006; Hunfeld et al., 2002) and psychological functioning (Kashikar-Zuck, Vaught, Goldschneider, Graham, & Miller, 2002; Kashikar-Zuck et al., 2011), with increases in the rates of depression (Pinquart & Shen, 2011) and anxiety (Tsao, Evans, Seidman, & Zeltzer, 2012) noted for chronic pain patients in comparison with healthy control subjects.

The impact of chronic pain on functioning varies considerably across pediatric patients, supporting the need to identify factors that contribute to this variability. Individual and familial factors appear to play an interdependent role in pediatric functional outcomes. Prior research indicates

that parents play an instrumental role in pediatric chronic pain, directly and indirectly influencing children's experience of pain (Palermo & Chambers, 2005). As such, parents of children with chronic pain report increased rates of psychological distress (Eccleston, Crombez, Scotford, Clinch, & Connell, 2004; Hunfeld et al., 2001; Lipani & Walker, 2006; Walker, Claar, & Garber, 2002). In turn, research has shown that parents' responses to their children's symptoms are connected to the child's experience of chronic pain. The impact of parental responses on pediatric disability is noted to have its foundation in social learning theory such that parents shape their children's pain responses through positive (e.g., providing attention for pain expression) and negative reinforcement (e.g., withdrawing attention for healthy coping; Bandura, 1977; Connelly et al., 2010). Protective parenting responses are a pattern of reinforcement that can inadvertently result in an increase in the child's report of symptoms and subsequent pain-related disability. These parental responses can serve as a means of caretaking in the short-term. However, over time, the maintenance of these parental protective responses can have the effect of sustaining pain-related disability through positive and negative reinforcement of disability. Research has also demonstrated that protective parenting responses, in particular, have a significant impact on children's adverse outcomes (Claar, Simons, & Logan, 2008; Simons, Claar, & Logan, 2008) and functional disability (Guite, McCue, Sherker, Sherry, & Rose, 2011; Langer, Romano, Levy, Walker, & Whitehead, 2009; Sieberg, Williams, & Simons, 2011). Prior research has also linked parent protective responses to increases in school absences (Brace, Smith, McCauley, & Sherry, 2000), duration of symptoms (Walker et al., 2002), and health care utilization (Walker, Levy, & Whitehead, 2006).

Adaptive coping strategies exhibited by the adolescent or encouraged by the parent, such as acceptance and/or adaptation to symptoms (Walker, Smith, Garber, & Claar, 2005), can buffer the effects of pain, whereas maladaptive coping patterns can exacerbate symptoms (Compas et al., 2006). One form of maladaptive coping is pain catastrophizing, which refers to the extent to which one magnifies, ruminates, or feels helpless about pain (Crombez et al., 2003; Sullivan et al., 2001). More specifically, pain catastrophizing is thought to serve as a means for communicating pain-related distress, which in turn results in heightened assistance and empathetic responses from parents (Craig, 2009; Sullivan, Adams, & Sullivan, 2004; Vervoort et al., 2008). Research suggests that the extent to which one catastrophizes about pain is impacted by reinforcement (e.g., parental responses), which in turn is positively correlated with functional

disability (Guite, McCue, et al., 2011; Peterson & Palermo, 2004). Moreover, pain catastrophizing was found to mediate the significant relationship between parent protectiveness and functional disability in adolescents with chronic pain at the time of an initial pain clinic evaluation (Guite, McCue, et al., 2011).

Adolescents with chronic pain often require an interdisciplinary treatment approach comprising medical, psychological, and physical interventions to address the complex nature of their condition (Institute of Medicine [IOM], 2011; Walco, Rozelman, & Maroof, 2009). Research in adult chronic pain populations has shown that participation in interdisciplinary clinics reduces pain-related disability, improves mood (Dobscha et al., 2009), and increases involvement in daily life activities (Flor, Fydrich, & Turk, 1992). There is limited available research focusing on the effectiveness of pediatric interdisciplinary pain clinic participation. One study examined treatment engagement after an initial outpatient pediatric interdisciplinary pain clinic evaluation and found associations with decreases in doctor's visits, somatic symptoms, functional limitations, and pain at 3-month follow-up (Perquin et al., 2000; Simons, Logan, Chastain, & Cerullo, 2010).

The current study used a prospective naturalistic design to examine relationships among parental protective responses, pain catastrophizing, and functional disability for adolescents and their parents participating in an outpatient pediatric interdisciplinary pain clinic. This study built on the findings from Guite, McCue, et al. (2011) by attempting to replicate the findings with a different sample of participants, contributing parent-child dyadic information, and examining the stability of these relations over time. First, this study examined associations among the variables of interest: parent protective responses to pain, pain catastrophizing, and functional disability at both time points. We hypothesized that there would be significant positive correlations among the study variables at both time points and between parent and adolescent reports. Second, we examined whether pain catastrophizing mediated the expected relation between parent protective responses and functional disability at both Time 1 (T1) and Time 2 (T2). We hypothesized that pain catastrophizing would be a significant mediator of the relation between parental protective responses and functional disability at each time point. Pain catastrophizing was examined as a mediator based on previous research documenting it as a significant mediator of the parental protectiveness—functional disability relation (Guite, McCue, et al., 2011) and social learning theory, which suggests that parental responses in the form of either punishment or reinforcement

shape children's behaviors. We hypothesized that higher levels of parent protectiveness would be associated with worsening functional disability through increased pain catastrophizing at both time points for each reporter. As an exploratory analysis, we evaluated whether change in parent protectiveness between the initial interdisciplinary pain management evaluation and 2 months later (T2–T1) predicted later functional disability at T2 and was mediated by pain catastrophizing at T2.

Methods

Participants

A total of 127 adolescents and their parents were prospectively recruited between 2007 and 2010 from a large pediatric institution that provides specialized tertiary care for the management of chronic pain. Patients were contacted before their initial evaluation appointment, and consent/assent was provided to participate in an Institutional Review Board-approved protocol exploring multiple aspects of psychosocial functioning in pediatric chronic pain. Three articles have been previously published from this data set with foci including measurement validation (Guite, Logan, Simons, Blood, & Kerns, 2011), treatment expectations (Guite et al., in press, a), and readiness to change (Guite et al., in press, b). Patients were referred from a variety of medical subspecialties (e.g., orthopedics, rheumatology) and primary care pediatricians, usually after other treatment attempts failed to substantially reduce symptoms. Adolescents in this sample were eligible for participation if: (1) they had a primary complaint of musculoskeletal pain (including, but not limited to, complex regional pain syndrome, fibromyalgia, or idiopathic musculoskeletal pain syndromes) lasting 3 months or longer, (2) their musculoskeletal pain was not related to chronic disease (e.g., juvenile idiopathic arthritis, lupus, abnormal biomechanics), and (3) they were English-speaking and not significantly cognitively impaired (e.g., as indicated by a diagnosis of mental retardation).

All participants in this study participated in a prospective naturalistic observational design and consented/assented to provide self-reported information at two time points: (a) T1—preceding the initial pain clinic evaluation via measures mailed to the home and returned to the team before the initial evaluation and (b) T2—2 months later via telephone follow-up calls. During the initial evaluation, both parents and adolescents were seen by a pediatric pain physician and a pediatric psychologist who provided integrative feedback to the family and collaboratively developed a treatment plan. This individualized plan included recommendations for one or more treatments targeting

physical activity, psychological, and medical (e.g., medication, further testing) intervention domains. Consistent with the naturalistic observational design of the study, patients were free to initiate and begin to pursue treatment recommendations during the 2-month period between T1 and T2. Treatment recommendations primarily included outpatient services. Although a subset of patients would have been referred to an intensive inpatient/day hospital-based pain treatment program, few would have had the opportunity to enroll within a 2-month period before T2 follow-up owing to the lengthy wait list. After the initial pain clinic evaluation, six adolescent/parent dyads were subsequently excluded based on pain diagnosis criteria, and only one dyad chose to discontinue participation at the time of the T2 follow-up contact. Thus, a total of 121 adolescent and parent participants were included in the current analysis.

Patient participants ranged in age from 11 to 18 years. They were primarily female, and the majority identified as Caucasian. All adolescent participants met criteria for chronic pain, which is pain lasting longer than 3 months (see Table 1). Parent participants ranged in age from 31 to 63 years of age, with the majority of parent participants accompanying adolescents to the initial clinic appointment being mothers.

Procedure

At the time of scheduling the initial clinic appointment, families received an introductory letter describing the interdisciplinary pain clinic evaluation and providers, questionnaires to assess medical history and psychosocial functioning, and a description of the research project. Families were screened for eligibility before their initial pain clinic evaluation. All patients and parents provided consent and assent for participation in the study in person, before the initial clinic evaluation, and all T1 measures were completed before participation in the clinical evaluation. Participating dyads were contacted again by phone, by a trained research assistant who was not a member of the clinical team, ~2 months after the initial clinic evaluation (T2) to complete follow-up questionnaires.

Measures

Pain Management Overview Questionnaire

At T1, parents provided information about the adolescent's pain, health history, and family demographic information. Variables include adolescent age, sex, ethnicity, grade, parent participant, pain duration, and pain intensity. Adolescents reported on their usual, most, and least pain

Table 1. Demographic Characteristics of Study Sample ($n = 121$)

Characteristics	Mean or n	SD or %
Adolescent age	15.58	1.53
Sex: female	97	80.2%
Ethnicity: Caucasian	108	89.3%
Grade in school	9.61	1.57
Parent age (mothers)	45.87	4.98
Accompanying parent (mothers)	111	91.7%
Parent education (mothers): college graduate	44	37.3%
Hollingshead Socioeconomic Status	49.49	10.32
Pain duration: months	25.13	26.15
Pain diagnosis		
Amplified musculoskeletal pain–diffuse	49	40.5%
Complex regional pain syndrome–type I	31	25.6%
Amplified musculoskeletal pain–localized	28	23.1%
Intermittent pain–diffuse	4	3.3%
Intermittent pain–localized	3	2.5%
Back pain	3	2.5%
Abdominal pain	1	0.8%
Chest pain	1	0.8%
Limb pain	1	0.8%
Pain intensity visual analog scale		
Usual	58.7	21.56
Least	37.1	22.75
Most	85.1	18.08

intensity during the preceding 2 weeks at T1 using a 100-mm visual analog scale. Scores were anchored at (*no pain*) to 100 (*unbearable pain*), with higher scores reflecting greater pain intensity. At T2, pain reports were collected over the phone verbally, using a numeric pain scale with the same anchor points. Visual analog scale pain intensity ratings have established reliability and validity (McGrath, 1990; Price, McGrath, Rafii, & Buckingham, 1983).

Adult Responses to Children's Symptoms

At both time points, adolescents and parents reported on this 29-item measure that assesses parental responses to the adolescent's pain that includes items reflecting parental protectiveness, minimization of pain, and encouraging and monitoring responses (Van Slyke & Walker, 2006). The stem for each item is, "When you have pain, how often do your parents . . .?" or "When your child has pain, how often do you . . .?" Responses are rated on a 5-point scale ranging from 0 (*never*) to 4 (*always*), and subscale scores are computed by calculating the mean ratings for items on each subscale. Higher scores indicate greater frequency of a particular parental response. Within this study, we specifically examined the "Protect" scale, which focuses on protective parental behaviors such as giving the child

special attention and limiting the child's normal activities and responsibilities. Throughout this article, we refer to this scale as "Protective Parental Responses to Pain" or "PPRP." Alpha coefficients for the Protect scale within chronic pain clinic samples have demonstrated good reliability (Claar, Guite, Kaczynski, & Logan, 2010); alpha reliabilities for the Protect scale in the adolescent sample were 0.86 for T1 and 0.89 for T2 and 0.86 at T1 and 0.89 at T2 for the parent sample.

Pain Catastrophizing Scale for Children and Parents

At both time points, adolescents and parents responded to this 13-item, self-report measure, which assesses threatening beliefs about the adolescent's pain. The stem for each item is, "When I have pain, I . . .?" or "When my child has pain, I . . .?", and items were rated on a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). A total score reflecting the adolescents' and parents' tendencies to ruminate, magnify, and/or feel helpless about their pain was examined. Higher scores indicate stronger pain catastrophizing beliefs. An alpha coefficient for the total score on the Pain Catastrophizing Scale for Children (PCS-C) was 0.91 for T1 and 0.93 for T2 (Crombez et al., 2003), and for the Pain Catastrophizing Scale for Parents (PCS-P), it was 0.94 at T1 and 0.92 at T2 (Goubert, Eccleston, Vervoort, Jordan, & Crombez, 2006).

The Functional Disability Inventory

At both time points, adolescents and parents reported on this 15-item measure to assess the degree to which pain interferes with the adolescent's physical functioning (e.g., eating, sleeping, walking, running) and other age-appropriate activities (e.g., attending school, gym/sports, spending time with friends) in the last few days before assessment. Items are rated on a 5-point scale ranging from 0 (*no trouble*) to 4 (*impossible*). Higher scores indicate greater functional disability. The Functional Disability Inventory (FDI; Walker & Greene, 1991) has demonstrated reliability and validity among patients consulting pediatric pain clinics samples (Kashikar-Zuck et al., 2011); alpha reliabilities for the adolescent sample were 0.91 at T1 and 0.94 at T2, and they were 0.93 at T1 and 0.95 at T2 for the parent sample.

Data Analyses

Descriptive statistics such as means and standard deviations were computed to describe the sample. Pearson's correlation coefficients were derived to assess associations among study variables, and paired-samples *t*-tests were conducted to examine the difference in scores between T1 and T2. Then, for both time points, separate mediation

analyses were conducted to examine the direct effects of parent protectiveness on the outcome variable, functional disability, and the indirect effect of pain catastrophizing on the parent protectiveness—functional disability relation.

Mediation was tested using the SPSS macro, PROCESS (Hayes, 2012). Specifically, a series of linear regression models were fitted, and the size and the significance of the indirect effects were estimated by a bootstrap procedure. Bootstrapping, a non-parametric resampling procedure, was used to estimate the indirect effects and construct confidence intervals (CI) (Bollen & Stine, 1990; MacKinnon, Lockwood, & Williams, 2004; Preacher & Hayes, 2004; Shrout & Bolger, 2002). The indirect effect is deemed statistically significant different from zero if the corresponding bootstrapped CI does not contain zero. Each analysis used 10,000 bootstrapped samples. Bootstrapping has several strengths including that it makes no assumptions about the shape of the distribution, is not based on large-sample theory and thus can be applied to small samples, and decreases the chance of both Type I and Type II error (Preacher & Hayes, 2004). Moreover, this mediation approach does not require a significant overall relation between the independent and dependent variable (MacKinnon & Fairchild, 2009). For the exploratory analysis, mediation analyses were similarly conducted to examine the direct effect of the change score in parent protectiveness from T1 to T2 (PPRP_{T2-T1}) on functional disability at T2 and the indirect effect of pain catastrophizing at T2 on the PPRP_{T2-T1} – T2 functional disability relation.

Results

Descriptive and Preliminary Analyses

To address hypothesis 1, correlations for study measures are presented along with means and standard deviations in Table II. As predicted, our findings indicated significant correlations among the parent- and adolescent-reported PPRP, PCS, and FDI measures at both T1 and T2 and also provided the necessary preconditions for further tests of mediation. Adolescent and parent reports were also significantly correlated with one another. In line with our hypothesis, when comparing scores at T1, results based on paired sample *t*-tests revealed significantly decreased levels or improvements in reported parent protectiveness, pain catastrophizing, and functional disability at T2 (see Table III).

To address hypothesis 2, mediation analyses with bootstrapping procedures (Hayes, 2012) were conducted to examine the indirect effect of self-reported pain catastrophizing on the parent protectiveness—functional

Table II. Pearson Correlations, Means, Standard Deviations Among Study Measures

Adolescent report						
Measures	1	2	3	4	5	6
1. PPRP T1	–	0.56**	0.34**	0.17	0.50**	0.16
2. PPRP T2	–	–	0.18*	0.54*	0.38**	0.33*
3. PCS T1	–	–	–	0.48**	0.44**	0.31**
4. PCS T2	–	–	–	–	0.31*	0.33**
5. FDI T1	–	–	–	–	–	0.55**
6. FDI T2	–	–	–	–	–	–
M	1.51	1.05	31.39	22.54	26.36	18.70
SD	0.74	0.78	10.32	11.83	11.86	13.83
Parent report						
Measures	7	8	9	10	11	12
7. PPRP T1	–	0.51**	0.44**	0.29**	0.51**	0.19*
8. PPRP T2	–	–	0.36**	0.65**	0.43**	0.26*
9. PCS T1	–	–	–	0.44**	0.37**	0.05
10. PCS T2	–	–	–	–	0.32**	0.29**
11. FDI T1	–	–	–	–	–	0.48**
12. FDI T2	–	–	–	–	–	–
M	1.44	0.95	27.07	19.81	24.63	16.86
SD	0.61	0.67	11.54	11.04	12.71	13.69

p* < .05; *p* < .01.

Table III. The *t*-test Relations Among Study Measures

Change scores _{T2-T1}	M	SD	<i>t</i> -test statistics
Adolescent report			
1. PPRP _{T2} –PPRP _{T1}	0.46	0.72	<i>t</i> (117) = 7.03, <i>p</i> < .001
2. PCS _{T2} –PCS _{T1}	8.96	11.26	<i>t</i> (117) = 8.64, <i>p</i> < .001
3. FDI _{T2} –FDI _{T1}	7.83	12.35	<i>t</i> (117) = 6.89, <i>p</i> < .001
Parent report			
4. PPRP _{T2} –PPRP _{T1}	0.55	0.76	<i>t</i> (117) = 7.98, <i>p</i> < .001
5. PCS _{T2} –PCS _{T1}	7.60	11.91	<i>t</i> (117) = 6.94, <i>p</i> < .001
6. FDI _{T2} –FDI _{T1}	7.85	13.55	<i>t</i> (117) = 6.29, <i>p</i> < .001

disability relation at both T1 and T2. Results of the adolescent model revealed a significant direct path of PPRP on FDI before an initial pain management appointment (T1; $\beta = 6.35$, $SE = 1.28$, $p < .001$) and approximately two months later (T2; $\beta = 4.51$, $SE = 1.66$, $p = .008$). Results of parent reports similarly revealed a significant direct path of PPRP on FDI at T1 (T1; $\beta = 8.97$, $SE = 1.79$, $p < .001$), but not at T2.

Results of this model supports adolescent self-reported pain catastrophizing as a significant mediator of the parent protectiveness—functional disability relation before an initial pain management evaluation (T1) with an indirect effect of 1.65 ($SE = 0.61$; 95% CI = 0.70–3.17). Parent report of the aforementioned variables trended towards

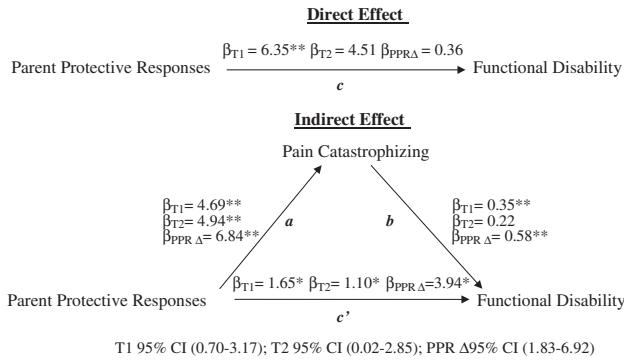


Figure 1. Adolescent-reported pain catastrophizing mediates the parent protectiveness–functional disability relationship across time points. * $p < .05$; ** $p < .01$.

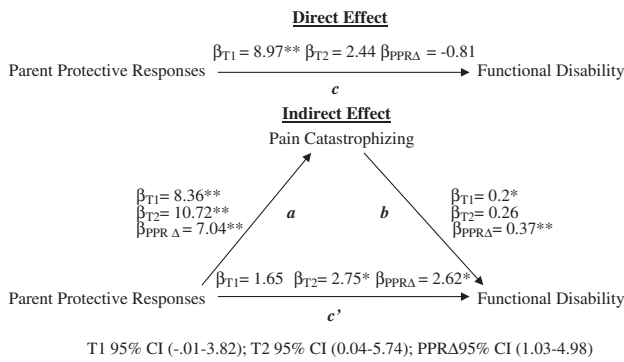


Figure 2. Parent-reported pain catastrophizing mediates the parent protectiveness–functional disability relationship across time points. * $p < .05$; ** $p < .01$.

significance, but the indirect effect was not significant. This relation was supported approximately two months later (T2) with an indirect effect of 1.10 ($SE = .70$; 95% CI = 0.02–2.85) and 2.75 ($SE = 1.44$; 95% CI = 0.05–5.74) for adolescents and parents, respectively (see Figures 1 and 2). These results mostly support our hypothesis that a greater frequency of protective parenting responses is associated with stronger pain catastrophizing beliefs, which in turn is associated with worsening functional disability at both time points. The one exception was that parent report did not support PCS as a significant mediator of the PPRP–FDI relation at T1; however, this relation was supported at T2.

Mediation analyses were used to explore whether changes (PPRP Δ) in parent protectiveness occurring between the initial pain management evaluation and approximately two months later (i.e., T2–T1) may help to understand the relationships among parent protectiveness, pain catastrophizing, and functional disability at T2. Examining the direct path model for both adolescent and parent report did not support PPRP Δ as a significant

predictor of FDI $_{T2}$. However, results did support PCS $_{T2}$ as a mediator of the relationship between PPRP Δ and FDI $_{T2}$ with an indirect effect of 3.94 ($SE = 1.30$; 95% CI = 1.83–6.92) and 2.62 ($SE = 0.97$; 95% CI = 1.03–4.98) for adolescents and parents, respectively (see Figures 1 and 2). Thus, these results indicated that an overall decrease in both adolescent and parent-reported parent protective responses between the initial pain management evaluation and approximately two months later was associated with lower levels of self-reported pain catastrophizing, which in turn was associated with improved functional disability over time.

Discussion

The purpose of this study was to examine the relations among protective parental responses to pain, adolescent pain catastrophizing, and adolescent functional disability before an initial pain clinic evaluation and approximately two months later. The contributive nature of parental responses (Langer et al., 2009; Guite, McCue, et al., 2011; Sieberg et al., 2011) and pain catastrophizing (Guite, McCue, et al., 2011; Peterson & Palermo, 2004) on disability has been previously documented in the literature. The results of the current study replicate previous findings within a separate sample of adolescents with chronic pain (Guite, McCue, et al., 2011), which found that parent protectiveness, pain catastrophizing, and functional disability were correlated, and that pain catastrophizing was a significant mediator of the relationship between parent protectiveness and functional disability before an initial pain clinic evaluation. In addition to replicating the findings before the initial pain management evaluation, the current study further extends our understanding of the aforementioned relations by replicating the findings within a different sample of participants, contributing dyadic reports, and demonstrating the function of these same variables over time, which could support possible clinical intervention targets.

As such, decreases in parental protectiveness, pain catastrophizing, and functional disability for both adolescents and parents were found 2 months following an initial pain management evaluation reflecting an improvement. These findings are consistent with previous research documenting significant improvement in patient symptoms and functioning 3 months following an initial evaluation (Claar & Simons, 2011). Results indicated that adolescents who reported a greater frequency of protective parenting responses were more likely to endorse stronger pain catastrophizing beliefs, which in turn was associated with

greater functional disability at both time points. In tandem, parents who reported fewer protective parenting responses were more likely to endorse less pain catastrophizing beliefs, which in turn was associated with parental perceptions of less disability 2 months following the initial evaluation. These results provide additional support for pain catastrophizing as a significant mediator of change in a pediatric chronic pain population (Crombez et al., 2003; Guite, McCue, et al., 2011; Vervoort et al., 2008). An important additional contribution to this literature base is the extension of these findings to caregivers and the progression of these relations over time, which indicates that similar behaviors and beliefs are maintained 2 months following an initial pain management evaluation. Thus, the mediation model generally appears to be a stable process across T1 and T2, regardless of change in scores.

Given that our results support that pain catastrophizing mediated the relation between protective parenting responses and disability over time, the exact mechanism of change warranted further investigation. As such, we demonstrated that self-reported pain catastrophizing, following the pain management evaluation, mediated the relationship between change in parent protective responses and disability at follow-up. These results suggest that both parent and adolescent perception of change in parent protective responses over time appears to have a significant impact on pain catastrophizing and disability 2 months later, and that pain catastrophizing mediates this relationship. Collectively, these findings suggest that it is the change in parent protectiveness over time that helps to explain how later pain catastrophizing mediates the relationship between parent protective responses and later disability.

Though the exact components of the evaluation, which are associated with improvement, cannot be isolated, one possibility is that the initial pain management evaluation helps to align expectations for treatment and facilitates parents' ability to decrease protective behaviors that serve to limit functioning. Previous research found that parents accompanying their children to an initial evaluation had preconceived expectations for the evaluation. Specifically, before participation in an interdisciplinary pain clinic evaluation, parents reported that they were in search of more information and treatment options for chronic pain (Reid, Lander, Scott, & Dick, 2010). Furthermore, parents of children with adaptive coping skills have been found to have high expectations for the effectiveness of psychological treatment options (Claar & Simons, 2011). The design of our study did not include a comparison group or non-evaluated youth with chronic pain, which would allow us to more specifically examine

what role the initial evaluation plays in modifying expectations or decreasing parent protectiveness over time. Nevertheless, our findings would suggest that these factors are important to evaluate in future research.

Previous research has emphasized the importance of integrating parent and family factors into our understanding of the complex nature of pediatric chronic pain, positing that parenting variables impact chronic pain within the context of dyadic and family-level variables (Palermo & Chambers, 2005). We would argue that our results provide support for protective parenting responses as a dyadic variable such that parenting factors have an impact on adolescent pain catastrophizing and functional disability. Moreover, our results indicated that it is important for clinicians to assess protective parenting responses to the adolescent's pain and to provide education about the inadvertent role that these behaviors can serve in maintaining adolescent disability, with the goal of decreasing these behaviors and increasing adolescent functioning. Thus, interventions grounded in operant theories of behavior aimed at decreasing the frequency of protective parenting behaviors in response to adolescent pain may play an important role in helping to decrease adolescent functional disability over time. Within a clinical setting, focusing greater attention on the role of parental reinforcement on adolescent coping and disability may help to improve adolescent disability at follow-up.

Study findings should be considered with respect to several limitations. The naturalistic design of the study did not include a comparison group of non-evaluated/treated adolescents to determine whether the initial evaluation played a causal role in decreasing parental protectiveness and other outcomes. As such, our study did not account for the specific content of the pain management evaluation or specific treatment-related factors that may have occurred between T1 and T2 that would allow us to understand additional details of "how" these variables change over time. The study also did not account for variables outside of the evaluation and treatment (e.g., life events, expectations), which may have also played a contributive role. Furthermore, only two time points were collected within a 2-month period, which limits our ability to draw important conclusions about longer-term functioning for adolescents with chronic musculoskeletal pain.

It will be important for future researchers to examine whether particular interventions targeted during an initial pain management evaluation can result in improvement in outcomes. Continued effort to identify specific variables that predict improved outcomes, and the best means for altering them, will allow clinicians to focus their efforts on these factors at an initial visit. In summary, our results

indicate that adolescents and parents who reported improvement in parents' protective responses during the course of 2 months reported less pain catastrophizing, which in turn was associated with less functional disability over time.

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