The longitudinal impact of parent distress and behavior on functional outcomes among youth with chronic pain

Erika T. Chow, MS[1,2], **John D. Otis, PhD**[3,4,5], and **Laura E. Simons, PhD**[1,6,7]

[1]Division of Pain Medicine, Department of Anesthesiology, Perioperative and Pain Medicine, Boston Children's Hospital, Boston, MA

[2]Boston University School of Medicine, Boston, MA

[3]Research Division, VA Boston Healthcare System, Boston, MA

[4]Department of Psychiatry, Boston University School of Medicine, Boston, MA

[5]Department of Psychological and Brain Sciences, Boston University, Boston, MA

[6]Department of Psychiatry, Harvard Medical School

[7]P.A.I.N. Group, Boston Children's Hospital and Center for Pain and the Brain

Abstract

Accumulating evidence supports the concurrent association between parent distress and behavior and child functioning in the context of chronic pain, with existing longitudinal studies limited to a pediatric surgical context that identify parent catastrophizing as influential. In this study, we examined how parent factors assessed at a multidisciplinary pediatric pain clinic evaluation impact child psychological and functional outcomes over time. A cohort of 195 patients with chronic pain (ages 8–17) and their parents who presented for a multidisciplinary evaluation completed measures at baseline and at four-month follow-up. Patients completed measures of pain catastrophizing, pain-related fear and avoidance, generalized anxiety, depressive symptoms, and functional disability. Parents completed measures of pain catastrophizing, pain-related fear and avoidance, and protective responses to child pain. Parent reported child school functioning was also collected. Parent distress and behavior was concurrently associated with child distress and functioning at evaluation. After controlling for baseline child functioning, baseline parent avoidance and protective behavior emerged as significant predictors of child functioning at four-month follow-up. Parent distress and behavior influence child distress and functioning over time and these findings identify key parent domains to target in the context of a child's pain treatment.

Corresponding Author: Laura E. Simons, Ph.D., Boston Children's Hospital, 21 Autumn St., Boston, MA 02215, Tel: (617) 919-4677; Fax: (617) 730-0759, ; Email: Laura.Simons@childrens.harvard.edu

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Introduction

The correlation between parent distress and behavior and child psychological and physical functioning has been established[4, 16, 17, 29, 35, 50], and several recent models have been proposed to map out how parent factors interrelate and influence the child's pain experience[42][6][15][28]. Among the current cross-sectional findings, parent catastrophizing has been linked to a parent's tendency to encourage their children to control pain rather than engage in activities, which impacts child disability[52], child anxiety[29], child depressive symptoms[29, 36], and child pain catastrophizing[12]. Parent catastrophizing and protective behavior has also been shown to directly affect school attendance and functioning, with protectiveness mediating this relationship[17]. These two parent factors have also been demonstrated to influence disability in a different order with parent protectiveness impacting functional disability indirectly through pain catastrophizing[50]. Lastly, parent avoidance of activities has been shown to indirectly contribute to child avoidance and parent fear indirectly contributing to child distress[28].

Collectively these investigations have focused on how parent distress and behavior relate to the existing psychological and functional disability profile of a child with little work done on how child psychological and physical functioning is affected over time, particularly in a pediatric chronic pain setting. Existing longitudinal studies have examined the influence of parent factors on child outcomes in the context of surgery. These studies have identified parent catastrophizing as a key cognitive bias associated with worse outcomes in children[24][32][25].

A profile of parent distress and behavior and how they impact a child's chronic pain over time is needed and would greatly contribute towards refining the models that have been put forth. The goal of this study is to provide initial data regarding the influences of parental distress and behavior on a child in the context of chronic pain over time. The data from this study could inform future directions of treatment of pediatric chronic pain involving parents. Current interventions that address parent influence on the pediatric chronic pain experience generally focus on operant techniques that teach parents how to respond to a child's pain or how to encourage a child to cope with the pain[10]. Despite the accumulating evidence that parent distress can influence a child's pain experience, none of these treatments directly targeted parent distress nor the effect it could have parent behavior and consequently on child distress and behavior[10]. Two recent interventions do seem to be more focused on the parent experience – one through the use of art therapy[30] and another focused on parent problem-solving skills[27]. The problem-solving intervention yielded promising results of decreased parental distress and protective behavior with concomitant improvements in child distress and functioning (without the child even involved in direct treatment)[27]. A primary goal of the current study is to not only provide impetus for more parental interventions but also help to identify specific targets to be addressed.

For this investigation, parent pain-related distress was represented by pain-related fear, magnification and rumination, and helplessness. Parent behavior was represented by avoidance of activities and protective behavior. We hypothesized that 1) parent distress and behavior would be associated with child pain-related distress and functioning at baseline, 2) associations between baseline parent factors and child outcomes at 4-months would continue to be significantly related, albeit more modestly, and 3) after controlling for the predictive effects of child baseline factors and age (given that previous studies suggest that the interplay of child and parent factors may change as a child gets older and cognitions change[2], we controlled for child age in our predictive models), parent distress and behavior would significantly predict child pain-related fear, avoidance of activities, pain catastrophizing, depression, anxiety, functional disability, and school functioning.

Methods

Participants and procedure

Children with chronic pain aged 8 to 19 and an accompanying parent who consecutively presented for initial evaluation from January 2012 to April 2014 at the Chronic Pain Clinic at Boston Children's Hospital were invited to participate, thus minimizing selection bias. Patients were recruited regardless of pain site, diagnosis, or duration. The only inclusion criteria were that patients needed to be able to speak English sufficiently to complete the measures (since the measures used have not had their validity tested in other languages), and patients must have been 8 years or older to ensure the ability to read and understand the questionnaire items.

Patients and their parents were consented/assented for the study by a research assistant and asked if their responses to the clinic evaluation measures could be used in addition to measures that were completed as part of a larger IRB-approved study designed to develop a child screening tool for pediatric pain[38]. Within this larger cohort (n=321) we tested the Interpersonal Fear Avoidance Model, which examined child and parent variables, but only focused on the child outcome of disability and did not look at these relationships longitudinally, which is the primary aim of the current study[4]. The current sample size was determined by the larger IRB-approved study thus we conducted a sensitivity analysis to determine if our study was sufficiently powered to detect significant effects using G*Power 3[11]. With an alpha set at 0.05, power set to 0.80, total sample size of 195, and inclusion of 5 predictors in our regression models, we were powered to detect small effect sizes (f^2=0.068 or greater).

During the initial evaluation of the children, the treatment team consisting of a physician, a physical therapist, and a clinical psychologist met to discuss assessment and recommendations for treatment. The treatment recommended typically involved some combination of medical, physical, and psychological intervention. Within this study sample, for medical treatment, 69% were recommended a new medication or dosage change to the current medication. For physical therapy, 50% were recommended to initiate physical therapy and 29% were recommended to continue already existing physical therapy. For psychology, 70% were recommended to initiate outpatient psychological treatment and 33% were recommended to continue with their current provider. Overall patients were quite

adherent to medical medication recommendations (94%) and physical therapy recommendations (92%), while they were relatively less adherent to psychology treatment recommendations (73%)[38].

Four months after evaluation within the context of the screening tool validation procedures, patients and their parents were contacted via phone and asked to complete the same measures via REDCap surveys. REDCap (Research Electronic Data Capture) is a secure, web-based application to support data capture for clinical studies that provides: 1) an interface for validated data entry; 2) an audit trail for data manipulation tracking; 3) automated export procedures for data downloads to common statistical packages; and 4) procedures for importing data from external sources. Families received the REDCap surveys via email, with reminder calls made either until completion of measures or after three attempts. Upon completion of the follow-up measures, $10 was sent via email as compensation. The study was approved by the Institutional Review Board at Boston Children's Hospital.

Measures

Parent Distress and Behavior

Pain catastrophizing: The Pain Catastrophizing Scale for parents (PCS-P)[12] is a 13-item self-report measure rated on a 5-point scale that measures a parent's negative emotions toward a child's pain. Items are summed up to a total score ranging between 0–52, with higher scores indicating higher levels of pain catastrophizing. We looked at all three dimensions of the measure: Magnification, Rumination, and Helplessness. With evidence that the Magnification and Rumination subscales reflect one dimension of catastrophizing, they were combined for this study[29]. Alpha reliabilities for the two dimensions of the PCS-P were: 0.83 for Magnification/Rumination and 0.87 for Helplessness.

Fear of pain: The Parent Fear of Pain Questionnaire (PFOPQ)[4] assesses parental fears ("my child's pain causes my heart to pound or race") and avoidance behaviors ("when my child is in pain, I stay away from other people") regarding their child's pain[37]. It is a 21-item self-report measure on a 5-point Likert-type scale. For the purposes of this study, we looked at the Fear of Pain (7 items) and Avoidance of Activities (6 items) subscales to be consistent with the child FOPQ domains[4]. The alpha reliabilities are as follows: Fear of Pain ($\alpha = 0.87$) and Avoidance ($\alpha = 0.88$).

Protective behavior: Adult Responses to Children's Symptoms (ARCS)[7, 41] is a 29-item self-report measure that assesses a parent's protectiveness, minimizing, and encouraging responses to a child's pain. Responses are rated on a 5-point Likert-type scale. As the protect subscale has the greatest empirical support, it was used in this study. The Protect subscale has 13 items and refers to protective parental behavior towards a child such as giving the child special attention. The score for the subscale was generated by calculating the mean of all the subscale items. The alpha reliability for this sample was 0.88 for the Protect subscale.

Child Functioning

Pain catastrophizing: The Pain Catastrophizing Scale for children (PCS-C)[9] measures negative emotions related to pain. Higher scores indicate higher levels of pain catastrophizing. Recent evidence supports this measure as an 11-item unitary construct and was thus calculated as such in this study[29]. Internal consistency of the PCS-C in the study was 0.92.

Fear of pain: The Fear of Pain Questionnaire for children (FOPQ-C)[37] is a 24 item self-report questionnaire rated on a 5-point Likert-type scale that measures pain-related fear and avoidance behavior. Items are summed up for a total score, with a higher score indicating higher levels of fear of pain. The measure has two subscales: Fear of Pain (13 items) and Avoidance of Activities (11 items). The alpha reliabilities of the two subscales were: 0.90 for the Fear of Pain subscale and 0.90 for the Avoidance of Activities subscale.

Anxiety: The Revised Children's Manifest Anxiety Scale (RCMAS-2)[34] is a 49-item self-report measure consisting of yes/no questions aimed at determining the source and level of a child's anxiety. Internal reliability of the measure for this study was 0.93.

Depression: The Children's Depression Inventory short form (CDI2)[14] is a 28-item self-report measure assessing a child's depressive symptoms. Items are on a 3-point scale and summed up to a total depression score. Internal reliability for the current sample was 0.88.

Functional disability: The Functional Disability Index (FDI)[13, 33] is a 15-item scale where patients report their perceptions of how much physical trouble and difficulty they have had performing daily activities in the past two weeks. A total score is computed by summing all the items. The alpha reliability for this sample was 0.89.

School Functioning: The Pediatric Quality of Life Inventory (PedsQL)[44, 45] is a 23-item questionnaire that determines the overall health related quality of life of a child. A higher PedsQL score indicates better functioning. The School Functioning subscale (5 items) investigates how much children have an issue with paying attention in class, forgetting things, keeping up with schoolwork, and missing school due to not feeling well or due to doctor's appointments. Child self-reports and parent proxy-reports have been made for this measure, but it has been found that the parent report demonstrates more reliability and validity than the child's[42]. The internal consistency of the School Functioning subscale for this study was 0.86.

Statistical Analyses

SPSS version 21.0 was used to calculate descriptive statistics, correlations, internal consistencies, hierarchical regressions, and bootstrap mediations. Although there were few missing data points (see Table 1), any incomplete measures were set to missing and no imputation methods were used. Pearson Product Moment Correlations were conducted between parent and child measures at baseline to examine the bivariate relations between parent distress and behavior and child functioning concurrently. This correlation was

repeated across time between parent distress and behavior at baseline with child functioning at follow-up.

To evaluate how parent measures affected child outcomes at follow-up, a series of stepwise hierarchical regression analyses were performed. Each child outcome at four months was the dependent variable for each regression model. For each regression analysis, child baseline functioning and child age was entered in the first step. For the next step, all five parent factors were entered (fear of pain, avoidance of activities, protective behavior, helplessness, and magnification and rumination) and partial correlations were performed for each of the parent factors by calculating the t-statistic that each factor's coefficient would have if it were the next variable added into the regression. The individual t-statistics are then squared to calculate individual "F-to-enter" statistics, and the parent factor with the highest F-to-enter statistic that meets the threshold of $p < .10$ was entered into the regression equation. The process is repeated at each successive step until no parent factors have a significant F-to-enter statistic. The standardized regression coefficients were used to determine if parental measures had a significant effect on child outcome at follow-up.

In order to assess mediation, we used PROCESS for SPSS, a bootstrapping method (with n = 5000 bootstrap resamples), to assess longitudinal direct and indirect effects[31]. Bootstrapping is a method in which sampling distributions of a statistic from the full data are generated empirically, and point estimates and 99% bias-corrected and accelerated confidence intervals are generated for mediation effects. Mediation effects are broken up into various effects and their corresponding weights. The total effect (weight c) of an independent variable (IV) on a dependent variable (DV) is comprised of the direct effect (weight c') of the IV on the DV and the indirect effect (weight $a \times b$) of the IV on the DV through a proposed mediator (M). Weight a represents the effect the IV has on the M, and weight b is the effect the M has on the DV, not taking into account any effect of the IV. As a stringent cut-off point for our test of indirect effects, we only considered effects significant if zero was not contained in the confidence interval. The analysis was carried out with child functional disability at follow-up as the dependent variable. We entered child age at baseline as a covariate in order to control for the impact of age on the DV.

Results

Participants

Of the eligible 452 consecutive patients seen from January 2012 to April 2014, 321 patients were enrolled in a larger cohort study that was designed to develop a pain screening tool (71% recruitment rate)[38]. Of the 321 patients that enrolled, 195 patients (60.7%) completed follow-up measures and were therefore included in this analysis. There were no significant differences in any of the measures at the intake evaluation between the group of individuals who completed the follow-up (n=195) and those who did not respond to requests to complete follow-up measures (n=126).

Participants were mostly Caucasian (92.9%) and female (76.4%) as anticipated by the typical composition of patients in the clinic. The mean age of patients was 13.8 (SD=2.42). Primary pain diagnoses were reported as: Musculoskeletal pain (33.8%), Complex Regional

Pain Syndrome (CRPS; 17.9%), Headache (including migraine, tension, chronic daily, post-concussive, and combined headaches; 16.9%), Neuropathic non-CRPS pain (11.3%), Widespread Musculoskeletal (8.7%), Functional Abdominal Pain (3.6%), Endometriosis (2.6%), and other diagnoses (including Ehler-Danlos syndrome/joint hypermobility, juvenile rheumatoid arthritis, postural orthostatic tachycardic syndrome; 5.1%). Sixty-four patients (32.8%) had multiple pain diagnoses. Primary pain sites included: lower extremity (36.9%), back/neck/shoulder (20.5%), abdomen (including flank and chest; 15.9%), upper extremity (9.2%), head (including jaw, face, and ears; 7.7%), diffuse widespread pain (6.2%), and hip/pelvis (3.6%). Duration of pain ranged from less than one month to 14 years with a median duration of 12 months. Approximately 8% of patients reported having pain for less than 3 months; even though these patients do not meet the criteria for chronic pain, the fact that they were referred to a tertiary pain clinic suggests that their pain is above and beyond what acute pain sufferers would normally experience, and so their pain experience likely has many of the biopsychosocial markers of chronic pain.

Parents who participated were mostly mothers (94.4%) and most were married (69.2%). Parents were generally well educated, with 65.7% of mothers having obtained a college (42.6%) or graduate degree (23.1%) and 54.9% of fathers having obtained a college (30.3%) or graduate degree (24.6%).

Preliminary Analyses

Differences by gender—To determine if we need to control for child gender in subsequent analyses, we examined if there were differences in parent behaviors and distress and for child 4-month follow-up outcomes. No significant differences by gender emerged.

Baseline associations—All three aspects of parent distress (pain-related fear, magnification and rumination, and helplessness) showed the most significant associations with child pain-related fear and avoidance of activities. Additional bivariate associations with parent distress are detailed in Table 1. For parent behaviors (avoidance of activities and protective behavior), child pain-related fear and avoidance of activities were most strongly related, with additional significant associations with child anxiety, functional disability, child depression, and school functioning. Parent behavior was not correlated with child pain catastrophizing.

When examining the association between baseline parent distress and behavior with child outcomes 4-months later (Table 2), parent distress and behavior was no longer associated with child functional disability. Baseline parent distress was significantly associated with child pain-related fear, avoidance of activities, child anxiety, pain catastrophizing, and school functioning at 4-month follow-up. Parent behavior at baseline was related to child functioning (avoidance of activities and school functioning) and child distress (depression, anxiety, pain-related fear).

Hierarchical Regression Analysis: Parent distress and behavior predicting child outcomes at 4-month follow-up

Separate stepwise regression analyses were run for all child outcomes to determine how predictive parent measures were of child outcomes over time (see Table 3 for a detailed examination of each step-wise analysis). Among child outcomes, child depressive symptoms and school functioning at 4-month follow-up were significantly predicted by parent distress and behavior.

Depressive symptoms—Baseline child depression and parent avoidance of activities were significant predictors of child follow-up depressive symptoms, with baseline child depression ($\beta = 0.56$, $p < .01$) as the strongest predictor. Despite the fact that child depression at both baseline and follow-up was significantly associated with parent pain-related fear and protective behavior at the bivariate level, both parent factors lost significance as predictors when child baseline depression was accounted for in the model and were therefore excluded from the stepwise regression.

School functioning—Baseline child school functioning, parent avoidance of activities, and parent protective behavior were significant predictors of child follow-up school functioning, with parent avoidance of activities ($\beta = -0.29$, $p < .01$) as the strongest predictor, followed by parent protective behavior ($\beta = -0.19$, $p = .035$) (see Table 3). Child school functioning at both baseline and follow-up were significantly associated with parent pain-related fear at the bivariate level, but parent pain-related fear was not significant as a predictor when child baseline school functioning was factored into the model as a predictor.

Parent distress and behavior did not significantly predict child anxiety, fear of pain-related fear, avoidance of activities, pain catastrophizing, and functional disability at 4-month follow-up above and beyond the predictive value of child baseline measures and child age. Child follow-up anxiety was strongly predicted by baseline anxiety ($\beta = 0.75$, $p < .01$). Child follow-up pain-related fear was predicted by baseline pain-related fear ($\beta = 0.60$, $p < .01$) and child age ($\beta = 0.15$, $p < .05$). Child follow-up avoidance of activities was predicted by baseline avoidance of activities ($\beta = 0.57$, $p < .01$) and child age ($\beta = 0.18$, $p < .01$). Child follow-up pain catastrophizing was predicted by baseline child pain catastrophizing ($\beta = 0.48$, $p < .01$) and child age ($\beta = 0.16$, $p < .05$). Child follow-up functional disability was strongly predicted by baseline disability ($\beta = 0.34$, $p < .01$) and child age ($\beta = 0.24$, $p < .01$).

Mediation Analysis: Mediating effect of child baseline distress and functioning on the relation between parent baseline distress and behavior and child follow-up functional disability

As we did not expect a lack of correlation between parent baseline factors and child follow-up disability in the bivariate correlations, we examined if the parent baseline factors actually exert their influence *indirectly* through child baseline distress and functioning, in turn predicting child disability at follow-up. In order to limit the number of potential mediators entered into the analysis, we mapped each parent construct onto the corresponding child construct at baseline and mapped parent protective behavior with child avoidance of activities due to the strong correlation between the two constructs. The results of the

mediation analyses are presented in Table 4. Age had a significant effect on functional disability and thus was included in all mediation models. All parent factors at baseline had no significant effect on child functional disability at follow-up (c weights), which was consistent with our previous analyses.

Parent factors at baseline were positively and significantly associated with child factors at baseline (a weights) and child factors at baseline were positively and significantly associated with child functional disability at follow-up (b weights). When examining indirect effects, models for parent pain-related fear ($\beta = 0.19$; $BCACI = 0.06 - 0.38$), avoidance of activities ($\beta = 0.24$; $BCACI = 0.02 - 0.51$), and protective behavior ($\beta = 1.86$; $BCACI = 0.47 - 3.61$) were all significant; indicating that parent factors indirectly impacted subsequent child disability through its influence on child baseline factors ($a \times b$ path).

Discussion

Parent distress and behavior affect child psychological functioning and disability when a child is faced with chronic pain[28]. Understanding exactly how parent and child distress and behaviors interact with each other during a child's pain experience is useful for helping families target specific maladaptive behaviors. It could also be helpful for reinforcing beneficial behaviors that help a child cope with the pain experience. In the current study, we found that at the time of the pain clinic evaluation, parent pain-related fear, avoidance, and protective behaviors were consistently and robustly associated with child distress and functioning. When examining how parent distress and behavior influenced child outcomes at follow-up, parent avoidance and protective behaviors emerged as significant predictors of child depressive symptoms and school functioning. We also found evidence for the indirect influence of parent fear, avoidance, and protective behavior on child disability through its influence on child baseline pain-related fear and avoidance. Altogether, this study suggests that it is imperative to assess and address parent factors when treating a child with chronic pain.

Review of Findings

Parent protective behavior emerged as a significant predictor concurrently for child depression, anxiety, pain-related fear, avoidance of activities, functional disability, and school functioning, and it emerged as a significant predictor longitudinally for child school functioning. The cross-sectional findings are consistent with prior studies that found that parents engaging in protective behaviors restrict activities of their children to try to shield them from further harm[6]. As a result, children can become more fearful and hesitant to engage in future activities based on observing the distress[23] and behavior[46] of their parent. This disengagement can lead to deterioration of physical and school functioning[8, 17, 43], and children can develop symptoms of depression and anxiety as a result of persistent isolation and avoidance of peers and school[5]. Although the finding that parent protective behavior longitudinally predicts variance in child school functioning is novel, it is consistent with prior cross-sectional work wherein parent protective behavior mediates the effect of parent pain catastrophizing on child school functioning[17].

In addition to parent protective behavior, parent avoidance behaviors and pain-related fear emerged as influential. The parent fear of pain construct is a relatively new one[4, 37], so little research has been done to examine how parent fear of pain affects child functioning. In the current study, we found that parent avoidance of activities was significantly correlated with child factors at baseline, with the exception of child pain catastrophizing. These associations persisted at follow-up, particularly for child avoidance and school functioning. Longitudinally, parent avoidance emerged as a strong predictor of child depression, and it emerged as the strongest predictor of school functioning, surpassing the predictive value of baseline school functioning. Interestingly, prior work examining child pain-related fear and avoidance in relation to depression found that child avoidance was minimally predictive of child depression without inclusion of the direct influence of child distress[36]. The pattern of results was different when examining parent distress and behavior longitudinally. After controlling for child baseline depression, parent avoidance emerged as the strongest predictor for child depression, while parent pain-related fear did not emerge as a significant predictor.

The effect parent avoidance and protective behavior has on school functioning and child depression likely stems from parental modeling and social learning. When children observe their parents cancel plans or withdraw from others to cope with their children's pain problem, they adopt a similar behavioral response modeled by their parent[46]. Although parents are well-intentioned by providing increased support and attention to their child in pain, this can inadvertently reinforce illness behavior. Allowing the child a break due to persistent pain can be a relief in the short-term, but it can progressively lead to social isolation and greater psychological distress[5]. Child distress and illness behavior and parent avoidance and protective behavior can amplify each other and lead to worsening child functioning.

In addition to parent avoidance of activities, parent pain-related fear emerged as a concurrent predictor for all child factors at baseline. Our cross-sectional data is in line with previous studies on parent pain-related fear, which showed that the distress construct is significantly associated with child distress and functioning, in particular child fear of pain[4, 37]. However, it did not emerge as a significant predictor of any child follow-up factors. It appears that the behavioral avoidance dimension of parent fear of pain has a more significant effect on child pain-related functional trajectories.

Beyond assessment of parent fear, avoidance, and protective behaviors, the influence of parent pain catastrophizing on child outcomes was examined. Cross-sectionally there is extensive literature supporting the influential role of parent pain catastrophizing. Previous studies have found that parent catastrophizing has a significant effect on child disability[52] and anxiety[29]. Our correlations showed that helplessness along with magnification/rumination had significant associations with child anxiety and functional disability, which supports the previous studies. Our data also showed a significant correlation between parent pain catastrophizing and child pain-related fear. Only parent helplessness showed significant correlation with child depression; the association between parent catastrophizing and child depression has been drawn before[29, 36], but not using the parent helplessness subscale;

perhaps helplessness is the primary dimension that drives the association between parent pain catastrophizing and child depression.

In contrast to prior studies[18, 29], we did not find a significant association between parent pain catastrophizing and child outcomes longitudinally. It may be that parent catastrophizing is influential on the transition that children undergo from acute to chronic pain as parents impart their cognitive biases, but is less influential in the context of a child who has chronic pain and has already developed their own maladaptive pain-related cognitions and behaviors. Parent helplessness was associated with child depression at follow-up, but did not demonstrate enough significance in the stepwise regression. Given the conceptual and theoretical connection, the potential interplay between parental helplessness and child depression should be further explored.

Our data showed a notable lack of longitudinal correlation between parent baseline factors and child functional disability at follow-up, despite the fact that there has been previous cross-sectional work showing that parent protective behavior in particular influences child functional disability[50]. Given the prior evidence from studies, we conducted a mediation analysis to determine if there was an indirect effect of parent distress and behavior. We found that baseline parent pain-related fear, avoidance of activities, and protective behavior exerted an indirect influence on child functional disability at follow-up through child baseline pain-related fear and avoidance. These results are consistent with prior research that has demonstrated that parent distress exerts an indirect influence on child functioning[47].

Limitations

The results of this study must be considered in the context of its limitations. Our sample population was predominantly white and had high educational attainment. In addition, most of the parents that completed the surveys were mothers, so parental data would not have captured the differences in psychology and parenting that mothers and fathers display[48]. Our sample was recruited from one tertiary care pain clinic, which could limit the generalizability of the follow-up data and trends in child psychological and functional disability. In addition, we do not have specific data on the degree of parent involvement in child treatment to control for that influence. Lastly, we use the term 'predict' in describing the relation between baseline parent factors and child outcomes for simplicity, but do recognize that these are complex interactions along a child's pain trajectory. Although these data provide potential clinical targets for a functional analysis of behavior, we also recognize that patients are in an ongoing circle of interaction, as depicted in the Interpersonal Fear Avoidance Model of Pain[4].

Implications and Future Directions

The findings of this study support several elements put forth by the conceptual models of family involvement in pediatric chronic pain and suggests additional directions for future research. These results underscore that parent individual variables and dyadic interactions affect a child's pain experience cross-sectionally and longitudinally (in particular parent avoidance of activities and protective behavior), but further work is needed to examine the family environment as a whole[26]. Additional domains of inquiry include the role of school

and peers on the child's pain experience[15]. It is clear that more studies are needed to investigate the longitudinal effects of parent factors, parent-child interactions, family environment, school environment, and peer interactions.

Although evidence exists underscoring the importance of targeting protective parenting behaviors in the context of a child's pain treatment program, this study provides the first evidence for the longitudinal impact of parent behaviors on child outcomes. This suggests that interventions that target families of children with chronic pain must not only focus on increasing activity and the day-to-day functioning of the child, but also assess and address the degree to which the parent has been limiting their own activities. Parents who cope with their child's pain by withdrawing from friends and family or cancelling plans likely need support and encouragement in order for them to model how to live life in the presence of their child's pain. In particular, these parents could benefit from increased pain acceptance and psychological flexibility. Parent pain acceptance has been shown to be directly correlated with child pain acceptance and negatively correlated with parent protective behavior, child pain catastrophizing, and child fear of pain[39]. Parent psychological flexibility has also been shown to be positively correlated with child pain acceptance and functioning and negatively correlated with child depression and parent protective behavior[19, 49]. These parent psychological dimensions can be targeted in treatment, and there has been a track record for success in patients with chronic pain[1, 3, 20–22, 40, 51]. Additional research examining these parent dimensions is needed as well as the expansion and modification of parent interventions to address these additional and salient treatment targets.

Acknowledgments

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Perspective

Parent behavior, specifically avoidance and protective responses, influence child distress and functioning over time. Child pain treatment interventions should include influential parent factors to ensure successful outcomes.

- Parents' distress and behavior can longitudinally affect a child's chronic pain

- Parent avoidance and protective behavior are predictors of child functioning

- Pediatric chronic pain treatment should also address parent distress and behavior

Table 1

Bivariate correlations between parent and child baseline factors.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	Mean	SD	Range	N
Parent Baseline Measures																
1. Pain-related fear	--	.63*	.41*	.68*	.67*	.20*	.26*	.39*	.39*	.25*	.24*	-.19*	9.98	5.88	0–23	195
2. Avoidance of activities		--	.53*	.51*	.54*	.25*	.28*	.32*	.52*	.17	.32*	-.23*	8.02	5.46	0–21	195
3. Protective behavior			--	.45*	.31*	.27*	.25*	.29*	.46*	.09	.19*	-.24*	1.45	0.66	.06–2.9	188
4. Magnification and Rumination				--	.75*	.14	.21*	.37*	.35*	.19	.30*	-.06	16.5	5.14	3–28	173
5. Helplessness					--	.24*	.21*	.37*	.38*	.27*	.28*	-.07	11.0	6.08	1–24	178
Child Baseline Measures																
6. Depression						--	.72*	.54*	.49*	.45*	.43*	-.22*	57.4	12.7	36–90	189
7. Anxiety							--	.68*	.52*	.54*	.41*	-.29*	49.6	11.2	30–78	184
8. Pain-related fear								--	.73*	.76*	.51*	-.26*	25.3	12.2	2–52	189
9. Avoidance of activities									--	.58*	.50*	-.32*	20.9	10.6	0–44	188
10. Pain catastrophizing										--	.43*	-.26*	30.6	12.6	4–64	174
11. Functional disability											--	-.21*	21.3	11.4	0–49	192
12. School functioning												--	62.2	18.9	25–100	184

Note.

*
$p < 0.01$

Table 2

Bivariate correlations between parent baseline and child follow-up factors.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Parent Baseline Measures												
1. Pain-related fear	--	.63*	.41*	.68*	.66*	.25*	.23*	.31*	.26*	.25*	.09	−.25*
2. Avoidance of activities		--	.53*	.51*	.54*	.33*	.26*	.26*	.34*	.18	.10	−.36*
3. Protective behavior			--	.45*	.31*	.17	.16	.17	.27*	.05	.02	−.35*
4. Magnification and Rumination				--	.75*	.12	.15	.22*	.22*	.15	.07	−.16
5. Helplessness					--	.14	.16	.21*	.15	.19	.07	−.21*
Child Follow-up Measures												
6. Depression						--	.79*	.63*	.59*	.62*	.56*	−.53*
7. Anxiety							--	.60*	.49*	.56*	.40*	−.38*
8. Pain-related fear								--	.78*	.86*	.47*	−.42*
9. Avoidance of activities									--	.64*	.49*	−.55*
10. Pain catastrophizing										--	.51*	−.35*
11. Functional disability											--	−.38*
12. School functioning												--

Note.

*
$p < 0.01$

Table 3

Hierarchical stepwise regressions for parent baseline predictors of child functioning at four-month follow-up.

Variable	B	SE B	β	R^2 Change
Outcome: Child depressive symptoms				
Step 1				
Baseline child depressive symptoms	.53	.06	.59**	.38**
Age	.73	.33	.14*	
Step 2				
Baseline child depressive symptoms	.49	.06	.54**	.03**
Age	.79	.32	.16*	
Parent avoidance of activities	.39	.14	.18**	
Step 3				
Baseline child depression	.50	.06	.56**	.01[†]
Age	.78	.32	.15*	
Parent avoidance of activities	.53	.16	.25**	
Parent helplessness	−.25	.14	−.13[†]	
Outcome: School functioning				
Step 1				
Baseline child school functioning	.26	.10	.24**	.06*
Age	−.29	.77	−.03	
Step 2				
Baseline child school functioning	.21	.09	.17*	.14**
Age	−.36	.71	−.04	
Parent avoidance of activities	−1.67	.32	−.39**	
Step 3				
Baseline child school functioning	.17	.09	.14[†]	.02*
Age	−.45	.70	−.05	
Parent avoidance of activities	−1.23	.38	−.29**	
Parent protective behavior	−6.95	3.27	−.19*	

Note.

*
$p < 0.05$;

**
$p < 0.01$;

†
$p < 0.10$

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Table 4

Summary of mediation results for functional disability (5000 bootstrap samples)

	Independent Variable (IV)	Mediating Variable (M)	Dependent Variable (DV)	Effect of Age on DV	Effect of IV on M (a)	Effect of M on DV (b)	Direct effect (c')	Indirect effect (a × b)	BCACI for (a × b)	Total effect (c)
1.	Parent pain-related fear	Child pain-related fear	Functional Disability	1.33 **	.82 **	.24 **	−.08	.19	**.06, .38**	.12
2.	Parent avoidance of activities	Child avoidance of activities	Functional Disability	1.30 **	1.02 **	.24 **	.00	.24	**.02, .51**	.24
3.	Parent protective behavior	Child avoidance of activities	Functional Disability	1.45 **	7.48 **	.25 **	−.91	1.86	**.47, 3.61**	.96
4.	Parent magnification and rumination	Child pain catastrophizing	Functional Disability	1.42 **	.45 *	.15 *	.00	.07	−.02, .26	.07
5.	Parent helplessness	Child pain catastrophizing	Functional Disability	1.41 **	.59 **	.17 *	−.01	.10	−.01, .28	.09

Note:

*
$p < 0.05$;

**
$p < 0.01$.

Bolded values are significant indirect effects as zero is not contained in the confidence interval.