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Risk and resilience in pediatric pain: The roles of parent and adolescent catastrophizing and acceptance

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Abstract

Objectives: Both pediatric and parent pain catastrophizing and pain acceptance are key factors associated with pediatric pain outcomes; however, the interactive effects of these factors within the parent-child dyad have yet to be tested. The aims of this study were to examine: 1) the mediating role of child catastrophizing between parent catastrophizing and child outcomes (pain interference and mobility), 2) the mediating role of child acceptance between parent acceptance and child outcomes, and 3) whether child acceptance buffers the relation between parent catastrophizing and child catastrophizing, which in turn impacts child outcomes.

Methods: Cross-sectional data from 324 youth with chronic pain ages 10 to 17 years ($M_{age}=14.72$, ($SD = 2.12$); 73.1% female; 59 % Caucasian) and their parents were collected. Participants completed measures assessing pediatric PROMIS domains (mobility and pain interference), pain catastrophizing, pain acceptance, and child pain intensity. Mediation was conducted via 1000-draw bootstrap-adjusted analyses in Mplus.

Results: Parent pain catastrophizing was indirectly associated with child pain interference via child catastrophizing but was not associated with mobility difficulties in the mediation model. Parent pain acceptance was indirectly associated with both child pain interference and mobility via child acceptance. We did not find evidence of child acceptance buffering parent and child pain catastrophizing.

Discussion: The findings of this study highlight the need for caregiver involvement in multidisciplinary treatments to mitigate risk and enhance resilience in youth with chronic pain.

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Introduction

Pediatric chronic pain is a significant and common problem in youth, impacting an estimated 1.7 million children in the United States and incurring high economic costs to families and society.¹ Research has revealed risk factors that may be predictive of poorer outcomes and chronicity of pain in youth, whereas other factors have been identified that may facilitate more adaptive coping. To that end, models of risk and resilience in chronic pain have been proposed, largely in the adult literature,² and such models have been utilized to conceptualize frameworks for identifying modifiable psychosocial factors in the context of chronic pain. Only recently has a model of risk and resilience been proposed in pediatric chronic pain.³

Both adult and pediatric models describe risk factors (i.e., vulnerability factors), which may contribute to or predict poorer physical and psychological functioning and are often associated with maladaptive pain coping.² Resilience reflects the ability to maintain adaptive physical and psychological functioning in the face of difficulties or challenges.⁴ The interplay between risk and resilience highlights both stable and modifiable domains, considering the important contributions of both vulnerability factors and resilience factors in overall adjustment and adaptation to chronic pain. Previously in the adult chronic pain literature and now recently in pediatrics, pain catastrophizing and pain acceptance have been identified as two important risk and resilience mechanisms, respectively.

Pain catastrophizing is defined as a maladaptive cognitive and emotional response pattern that includes magnification, rumination and perceived helplessness about actual or anticipated pain.⁵ Child and parent pain catastrophizing have been identified as salient risk factors associated with poor functional outcomes. Specifically in youth, pain catastrophizing has been found to be related to or predictive of increased pain intensity and functional disability^{6–9} as well as depressive symptoms and poorer quality of life (QoL).⁷ Parents' catastrophizing about their child's pain has been found to predict child- and parent-reported functional disability and poorer school attendance,¹⁰ and is additionally associated with increased child pain behaviors⁷ as well as child anxiety and pain-related fear.¹¹ Research has cited stronger relations between child pain catastrophizing and functional outcomes (e.g., disability, depression, anxiety) than parent pain catastrophizing and outcomes.¹² Wilson and colleagues¹³ proposed and tested a model examining child catastrophizing as a mediator of parent catastrophizing and adolescent functional disability. They found that parental catastrophizing explained a substantial portion of variance in adolescent pain and disability; however, adolescent pain catastrophizing mediated this relation. When parent catastrophizing was entered as a mediator instead, the model was not supported. Thus, current literature supports the notion that parent catastrophizing predicts child functional disability *through* child catastrophizing.

Acceptance of chronic pain refers to a person's willingness to acknowledge the presence of pain along with positive activity engagement and a commitment toward living a meaningful life in the presence of pain.¹⁴ Among adolescents, chronic pain acceptance has been found to predict better quality of life¹⁵ and school functioning^{16, 17} and has positive associations with domains of physical and emotional functioning.^{18, 19} Research has also explored

parents' conceptions of their child's pain acceptance,²⁰ examining parental beliefs about their child's activity engagement and willingness to experience pain in the service of functional goals. Acceptance of pain from the parental perspective has been found to be inversely correlated with child functional disability, fear of pain, and parent catastrophizing.²⁰

The interactive effects of catastrophizing and acceptance within the parent-child dyad are unknown and remain of interest given the modifiable nature of these constructs and potential for intervention to bolster coping efforts.²¹ Vowles and colleagues²² developed a theoretical model of latent psychosocial constructs to disentangle how adolescent and caregiver behaviors in response to pain interact to predict adolescent functioning. Their model included adolescent psychological responses, caregiver psychosocial responses, and caregiver pain management behaviors. The most salient variables related to adolescent functioning within this model were adolescent pain catastrophizing and adolescent acceptance of pain. Vowles's model suggests that caregiver variables indirectly influence adolescent functioning, notably, through adolescent psychosocial responses to pain. This is consistent with the model explicated by Wilson et al., such that parental responses appear to play an indirect, yet important, role on child outcomes. Embedded within an ecological context that considers family environment, parent-reported risk and resilience mechanisms are important contributors to child outcomes and in need of further study. There has been a call for research to explore mechanisms and test model pathways of resilience in pediatric chronic pain,³ which includes supportive parent mechanisms that contribute to pain adaptation in addition to parent vulnerability factors which have already been attended to in the literature. The interactive effects of adolescent and parent pain catastrophizing and pain acceptance on outcomes in youth with chronic pain, has yet to be examined. It is unknown whether an adolescent's resilience, in this case acceptance, may mitigate the relation between parent's maladaptive coping (i.e., catastrophic thinking) and their child's functioning, given the impact and salience of youth's cognitive coping styles on their own outcomes.

The aims of the current study were to: 1) replicate previous findings on the mediating role of child catastrophizing between parent catastrophizing and child outcomes (pain interference and mobility), 2) examine the mediating role of child acceptance between parent acceptance and child outcomes, and 3) explore the potential buffering effect of child acceptance on the relation between parent catastrophizing and child catastrophizing, which in turn impacts child outcomes. To date, no previous research has examined these two specific outcome variables within models of child and parent catastrophizing or acceptance. First, we hypothesized that child catastrophizing would mediate the relation between parent catastrophizing and child outcomes (i.e., pain interference and mobility). Second, we predicted that child acceptance of pain would mediate the relation between parent acceptance and child outcomes (i.e., pain interference and mobility). Lastly, we predicted that catastrophizing and acceptance would be inversely related, and furthermore, that child pain acceptance would buffer the relation between parent catastrophizing and child catastrophizing on child outcomes.

Materials and Methods

Setting

All study procedures were approved by the university Institutional Review Board. The data for this study were collected as part of a larger chart review protocol utilizing the Pediatric Collaborative Health Outcomes Information Registry (Peds-CHOIR) within a tertiary care outpatient pediatric pain clinic on the west coast of the United States.²³ Peds-CHOIR employs an open-source, open-standard learning health care system (LHS) for longitudinal tracking of treatment outcomes.

Procedures

As part of standard clinical care, all patients and primary caregivers completed Peds-CHOIR, including demographic questionnaires and a series of patient reported outcomes, prior to their initial clinic visit. The majority of families completed the questionnaires at home through a secure URL link emailed to the caregiver when they registered for their initial clinic appointment. Those who did not complete questionnaires in advance of the appointment were provided with encrypted computer tablets in the clinic in order to complete them prior to their evaluation. Data were extracted retrospectively from adolescents and their parents who completed Peds-CHOIR between October 2015 and March 2017.

Participants

The clinic cohort of 324 pediatric patients ages 10-17 was largely female and non-Hispanic with diverse etiology pain with a mean pain duration of 30.2 months (SD = 35.2; Range = 1–198 months) as reported by primary caregivers. Table 1 provides more detailed demographic data for both adolescents and caregivers. The majority (85.8%) of primary caregivers who completed the questionnaires were (biological or adoptive) mothers; 10.8% were (biological or adoptive) fathers and 1.2% were “other” legal guardians/caregivers all of whom were female. There was missing demographic data from 7 caregivers (2.2%). Of the primary caregivers who completed Peds-CHOIR, 44.06% endorsed having a pain problem and 27.8% endorsed psychological difficulties. For the remainder of the paper primary caregivers will be referred to as “parents.”

Measures

Demographics.—Parents completed questions providing demographic data (e.g. age, sex, ethnicity/race) about themselves and information pertaining to their child’s pain and function.

Average Pain Intensity.—Adolescents rated their average pain intensity over the past month using a standardized 11-point numeric rating scale (ranging from 0 = no pain to 10 = worst pain possible) which has demonstrated validity in pediatric pain populations.²⁴

Pediatric PROMIS (Patient Reported Outcome Measurement Information System) Measures.—PROMIS was developed by the NIH Roadmap for Medical Research Initiative to provide efficient, validated, and patient-reported measures of health

and well-being for clinician and researcher use.²⁵ PROMIS instruments are standardized for the general US population as well as specific disease populations,²⁶ utilizing Item-Response Theory (IRT) to improve outcome measurement quality and precision. IRT and Computer Adaptive Testing (CAT)^{27, 28} are used by Peds-CHOIR to reduce patient burden and optimize scale completion by administering questions best suited for the reporter based on their responses to earlier questions from an item bank. The response is measured on a Likert scale (1 = “Never/Not able to do” to 5 = “Almost always/With no trouble”), and scores are based on T-score distribution with a mean of 50 and SD of 10. Pediatric PROMIS measures have been validated in children aged 8 to 17 years.²⁹ This study utilized two PROMIS domains: Pain Interference and Physical Function - Mobility.

Pain Interference.—The PROMIS pediatric pain interference item bank evaluates the impact of pain on physical, psychological, and social functioning (e.g., “It was hard for me to pay attention when I had pain,” “It was hard for me to have fun when I had pain”) over the past 7 days. Higher scores indicate greater pain interference in the child’s life.³⁰ Good internal consistency has been demonstrated for the PROMIS pediatric pain interference short form ($\alpha = 0.88$) and adequate test-retest reliability ($\alpha = 0.65$) of the CAT version has been found.³¹

Physical Function - Mobility.—The PROMIS pediatric mobility domain assesses physical activity and mobility (e.g., “I could stand up by myself,” “I have been physically able to do the activities I enjoy the most”) over the past 7 days. Higher scores indicate better mobility. Scores were inverted for consistency with other measures to indicate higher levels of dysfunction; therefore within the text and tables, this variable may also be referred to as “mobility difficulties” in order to clarify directionality of the findings. Previous research has indicated adequate internal consistency of the PROMIS short form pediatric mobility measure ($\alpha = 0.74$) and test-retest reliability of the CAT version ($\alpha = 0.72$).³¹

The Pain Catastrophizing Scale for Children (PCS-C) and Parents (PCS-P).—The PCS-C, adapted from the adult PCS, is a measure assessing catastrophic thoughts and feelings about pain and validated for youth (e.g., “When I am in pain, it’s terrible and I think it’s never going to get better”).⁶ The parent report (PCS-P)¹⁰ assess parents’ catastrophic thinking about their child’s pain (e.g., “When my child is in pain, it’s awful and I feel that it overwhelms me”). The PCS-C and PCS-P are both 13-item measures with a 5-point Likert scale (0 = “Not at all” to 4 = “Extremely”). Higher total scores signify greater levels of catastrophizing. Total PCS-C and PCS-P scales have demonstrated adequate internal consistency ($\alpha = .87$ and $.93$, respectively), as well as construct and criterion validity through confirmatory factor analysis and intercorrelations with measures of parental distress, child functioning, and child disability.^{6, 10} Modified electronic versions (e.g., word stems at the top of the screen with each item delivered on a separate page; instructions adapted for electronic administration) of both scales were utilized.

The Chronic Pain Acceptance Questionnaire for Adolescents (CPAQ-A) and Parents (CPAQ-P).—CPAQ assesses acceptance of chronic pain, a construct defined as acknowledging pain without unproductive attempts to control or reduce it and being able to

work towards a meaningful life despite pain.¹⁴ CPAQ-A is a 20-item measure adapted for adolescents with chronic pain from the original adult version of the CPAQ.^{19, 32, 33} The CPAQ-A is rated on a 5-point numeric rating scale (0 = Never True, 4 = Always True). The version adapted for parents of youth with chronic pain, (CPAQ-P) is a 16-item questionnaire, which reflects parents' report about their beliefs regarding their child's acceptance of pain. The CPAQ-P is rated on a 7-point numeric rating scale. Both the adolescent and parent questionnaires contain two subscales which assess *activity engagement* (i.e., degree of participation in daily activities despite pain) and *pain willingness* (i.e., the degree to which one allows pain to be part of his/her life without attempting to avoid or control it). Examples of the *activity engagement* subscale include "When my pain increases, I can still do things I have to do" or "When my child's pain increases, (s)he can still take care of responsibilities." *Pain willingness* subscale items include "Before I can make any real plans, I have to get some control over my pain" or "Before my child can make any serious plans, (s)he has to get some control over their pain." Higher score on both measures reflect greater acceptance of pain. The CPAQ-A has demonstrated good reliability in both subscales (Activity Engagement: $\alpha = .90$; Pain Willingness: $\alpha = .83$) as well as a total acceptance score ($\alpha = .91$).³² Construct validity of the CPAQ-A has been tested through its correlations with distress, disability and pain intensity.^{19, 32} The CPAQ-P also demonstrates adequate reliability in parents of youth with chronic pain ($\alpha = .89$)²⁰ including the two subscales: Activity Engagement ($\alpha = .89$) and Pain Willingness ($\alpha = .81$). Construct validity of the CPAQ-P is supported by negative correlations with parent pain catastrophizing, parent fear of pain, and protective parent responses to pain.²⁰ Stability of the measure was also supported by 1-month stability estimate of $\alpha = .72$.²⁰

Analytic plan

In the results section, the following abbreviations will be utilized for pediatric pain catastrophizing (PCS-C), parent pain catastrophizing (PCS-P), pediatric pain acceptance (CPAQ-A) and parent pain acceptance (CPAQ-P). All models were estimated as structural path models using Full Information Likelihood Estimation (FIML) in Mplus version 6.12.³⁴ Structural path modeling with FIML simultaneously estimates direct and indirect (i.e., mediated) relationships between observed variables using structural equation modeling, serves to estimate maximum likelihood functions for each individual on the basis of existing data, resulting in more realistic estimates than listwise deletion, and accounts for variable nonnormality. A mediated path analysis was conducted as a two-step process. Covariates (pain intensity ratings and patient age) were included in all models.

First, total effects of exogenous variables (e.g., parent pain catastrophizing or pain acceptance) were specified for each outcome variable (pain interference or mobility; the *c* path):

$$\text{Pain Interference} = \beta_1 * \text{PCS} - \text{P} + \beta_2 * \text{Pain Intensity} + \beta_3 * \text{Age} + \beta_0 \quad (1)$$

Second, the effect of the exogenous variable on the mediator (the *a* path; equation 2 below) was estimated, along with the effect of the mediator on the outcome variable (the *b* path, equation 3), above and beyond the effects of the exogenous variable and covariates.

$$PCS - P = \beta_1 * PCS - P + \beta_2 * \text{Pain Intensity} + \beta_3 * \text{Age} + \beta_0 \quad (2)$$

$$\text{Pain Interference} = \beta_1 * PCS - P + \beta_2 * PCS - C + \beta_3 * \text{Pain Intensity} + \beta_4 * \text{Age} + \beta_0 \quad (3)$$

Mediated effects were estimated using a 1000-draw bootstrap estimated product of coefficients approach.³⁵ This approach uses a product of the *a* and *b* path coefficients to determine the statistical significance of the mediation effect. It has been suggested to demonstrate superiority over the difference in coefficients (*c-c'*) approach due to higher statistical power and reduced risk of Type-I error.³⁶ Use of bootstrapping bias-corrected estimation for mediated effects has been deemed preferable to other forms of product of coefficients estimation approaches, such as the Sobel test, due to less-restrictive assumptions about distribution of the indirect effect and potentially greater statistical power.³⁷ Moderated models (testing the interaction of child ratings of pain catastrophizing and acceptance) on each outcome variable were tested by computing a separate interaction term and including it as an additional exogenous predictor:

$$\text{Pain Interference} = \beta_1 * CPAQ - P + \beta_2 * PCS - P + \beta_3 * \text{Pain Intensity} + \beta_4 * \text{Age} + \beta_5 * PCS - C * CPAQ - A + \beta_0$$

(4)

All exogenous variables were centered, and all path coefficients are presented in their standardized form to allow for comparison of relative size of effects. As our predicted models were saturated, with all potential paths between observed variables estimated, indices of model fit would have suggested perfect model fit and were thus excluded.

Results

Descriptive statistics are presented in Table 2 depicting means (SD), range, and bivariate correlations analyses. All study variables were significantly correlated with each other in the expected directions. Assumptions were tested for multicollinearity using a series of multiple regression models, and Variance Inflation Factors (VIF's) were all within the normal range. Assumptions were also tested for normality suggesting that our variables were normally distributed with small- to moderate skewness noted for average pain intensity, mobility and pain interference which is expected given the nature of the sample, and all values fell within ranges that are considered acceptable for analyses.

Model 1.

To test the hypothesis that child catastrophizing would buffer the effect of parent catastrophizing on child function, PCS-C was specified as a mediating variable between PCS-P and pediatric ratings of both pain interference and mobility difficulties (see Figure 1 and Table 3), controlling for age and pain intensity. When total effects were modeled, PCS-P was found to be a significant predictor of pain interference ($\beta = .219, p < .001$), but was not significantly related to mobility ($\beta = .083, p = .14$). PCS-P scores were significantly and positively associated with PCS-C scores ($\beta = .405, p < .001$). When PCS-C was tested as a mediator of the relationship between PCS-P and pediatric pain interference, our results suggested that PCS-C mediated this relationship (standardized $ab = .147, p < .001$) with the direct effect of PCS-P on pediatric pain interference non-significant ($\beta = .072, p = .17$). Thus, PCS-P exerts an indirect influence on pediatric pain interference via PCS-C. As there was not a significant total effect of PCS-P scores on pediatric mobility scores, no mediation analyses were conducted for this variable. Therefore, results supported our hypothesis for pain interference as an outcome variable, but did not support our hypothesis for mobility.

Model 2.

Next, to test the hypothesis that child acceptance would buffer the relation between parent acceptance and pediatric outcomes, CPAQ-A was specified as a mediating variable between CPAQ-P and pediatric outcomes (pain interference and mobility), controlling for age and pain intensity (see Figure 2 and Table 3). CPAQ-P scores showed a significant total effect on CPAQ-A ($\beta = .579, p < .001$), pain interference ($\beta = -.380, p < .001$) and mobility difficulties ($\beta = .266, p < .001$). CPAQ-A scores were significantly associated with pain interference scores ($\beta = -.454, p < .001$) and self-rated mobility difficulties ($\beta = -.283, p < .001$), above and beyond the effects of CPAQ-P, pain intensity, and age. CPAQ-A ratings were also found to significantly mediate the relation between CPAQ-P and pain interference (standardized $ab = -.263, p < .001$) and the relationship between CPAQ-P and mobility (standardized $ab = -.164, p < .001$) (Figure 2). In the fully specified model, when including CPAQ-A as a mediator, the direct effect of CPAQ-P on both mobility ($\beta = -.102, p = .14$) and pain interference ($\beta = -.117, p = .071$) was no longer significant. Results of Model 2 were consistent with our specified hypotheses.

Model 3.

Third, we examined a moderated mediation model such that CPAQ-A was tested as a moderator of the effects of PCS-C and PCS-P on both pediatric pain interference and pediatric mobility. CPAQ-A was not found to moderate any of the examined paths ($p > .40$ in all cases), which is contrary to our hypothesis that CPAQ-A would buffer the relation between PCS-P and PCS-C. Therefore, there is no model specifying these paths included.

To further elucidate the relationships between pain acceptance and pain catastrophizing, we opted to test an exploratory combined path model estimating the parallel effects of parent and pediatric pain catastrophizing and pain acceptance on pain interference and mobility ratings. This combined path model is depicted in Figure 3. Results indicated that only scores on CPAQ-A ($\beta = -.350, p < .001$) and PCS-C ($\beta = .184, p = .005$) demonstrated a significant relationship with pain interference; whereas only CPAQ-A ($\beta = -.306, p < .001$)

showed a significant effect on mobility. Neither PCS-P nor CPAQ-P ratings showed significant direct effects on pain interference or mobility in the fully-specified model ($p > .07$ in all cases). Unexpectedly, however, a positive relationship was noted between CPAQ-P and PCS-C ($\beta = .178, p = .007$). As a means of further examining this effect, we examined the independent contributions of the two subscales of the CPAQ-P (i.e., pain willingness and activities engagement).

Model 4.

Results of the fully-specified model, including CPAQ-P subscales (i.e., pain willingness and activity engagement), can be seen in Figure 4 and Table 3. Although not depicted in the Figure or Tables, bivariate correlations for the subscales of the CPAQ-P and variables of interest were also examined. These analyses revealed that activity engagement was positively correlated with the CPAQ-P pain willingness subscale ($r = 0.515, p < 0.01$), the CPAQ-A total scale ($r = 0.562, p < .01$) and negatively correlated with PCS-C ($r = -0.191, p < .01$); pain willingness was also positively correlated with the CPAQ-A total scale ($r = 0.512, p < .01$) and negatively correlated with PCS-C ($r = -0.381, p < .01$). Based on the fully specified model in Figure 4, both parent pain willingness ($\beta = .284, p < .001$) and activity engagement ($\beta = .379, p < .001$) were positively associated with CPAQ-A ratings. Notably, parent pain willingness was not significantly associated with PCS-C ($\beta = -.075, p = .26$); consequently, this path was omitted from the final estimated model represented in Model 4. The path from parent activity engagement to PCS-C was significant; however, the relation was the inverse of the hypothesized direction, such that greater parent activity engagement predicted higher PCS-C scores ($\beta = .284, p < .001$). The direct path from parental ratings of activity engagement to pain interference was non-significant ($\beta = -.019, p = .74$), yet both parent pain willingness ($\beta = -.136, p = .007$) and CPAQ-A ($\beta = -.361, p < .001$) were negatively associated with pain interference. Similarly, PCS-C scores ($\beta = .160, p = .011$) and child pain intensity ratings ($\beta = .196, p = .001$; covariate (not depicted in Figure 4) demonstrated significant and positive relationships with pain interference ratings. We also tested the interaction between age and CPAQ-P in the fully specified model, and this term was not statistically significant ($\beta = -.560, p = .12$).

Alternate models were tested by reversing the order of predictors, mediators and outcomes. The reversal of mediators and exogenous variables suggested a less optimal model; for example, parental ratings of PCS and CPAQ did not mediate the effect of child PCS and CPAQ on outcome variables. Furthermore, there was no significant relationship between parental variables and outcomes when the relationship partialled out the effect of child PCS or CPAQ. When the outcome variables were instead reversed and used to predict child PCS-C and CPAQ-A ratings, we did find significant relationships bi-directionally such that pain interference and mobility significantly predicted PCS-C and CPAQ-A.

Discussion

How a child functions in the presence of persistent pain is governed by a number of internal cognitive-affective factors as well as contextual influences. Importantly, there are elements that contribute to declines in function, such as pain catastrophizing, and those that enhance

participation in life, such as pain acceptance. The current study is the first to jointly examine these two important risk and resilience processes from an internal (child) and contextual (parent) perspective. Overall results were consistent with prior theory and extend current findings - parent pain catastrophizing and pain acceptance were related to child function indirectly via child pain catastrophizing and pain acceptance. Given the cross-sectional nature of the current study, causal or directional relations cannot be inferred, however, the findings as interpreted below provide possible explanations for our results.

This study also tested a new hypothesis - *does child pain acceptance serve as a buffer between pain catastrophizing and child functional outcomes?* This assertion was not supported. In testing this model, new questions emerged regarding the relations between parent pain acceptance and child catastrophizing that were further explored via examining parent pain acceptance, and more specifically to the two dimensions separately: pain willingness and activity engagement. These results suggested that perhaps incongruence in beliefs about behavioral engagement in the presence of pain between the parent and child may potentially be associated with greater pain-related distress. Certainly, this provides further avenues for inquiry.

In more specifically examining the results of this study, child pain catastrophizing was again identified as a mediator of parent catastrophizing and functional outcomes. However, this is the first study to explore pain interference and mobility, as measured by the PROMIS, as the outcome variables of interest. PROMIS Pain interference has demonstrated construct validity when compared to the Functional Disability Inventory, whereas mobility equates to the physical function subscale of the Pediatric Quality of Life Inventory Generic Core Scales (PedsQL).³⁸ Our study results remained consistent when comparing our mediational model to prior studies using FDI as the outcome.¹³ The mediation findings were not significant for mobility. Previous research has demonstrated child pain catastrophizing as a predictor of quality of life as measured by the PedsQL, of which the physical function scale is comparable to PROMIS Mobility⁹; however, no direct comparison is available in the literature to date for Mobility as an outcome variable. Given that the PedsQL includes multiple domains of function (i.e., social, psychological), this could explain the inconsistency.

Adolescent pain acceptance was found to mediate the relation between parental perception of pediatric pain acceptance and both pain interference and mobility as reported by youth. This is the first study to examine these relations between parent and child pain acceptance in pediatric pain. Previous research examining parents own acceptance of their child's pain, has demonstrated positive associations between parent acceptance and child pain acceptance as well as negative associations between parent acceptance and child outcomes such as functional disability.³⁹

We consequently sought to elucidate whether a child's resilience, as operationalized by acceptance, could buffer the impact of parental vulnerability factors on pediatric outcomes. Specifically, we explored whether pediatric acceptance could protect against the impact that catastrophic thinking in parents has on their children's thinking, which in turn impacts outcomes; however, results did not support this model. In the adult pain literature, studies

suggest that pain acceptance acts as a mediator between pain catastrophizing and disability.⁴⁰ Other research in adults with chronic pain has suggested that pain acceptance is a particularly strong predictor of pain interference and disability, and that pain acceptance is uniquely associated with these constructs above and beyond the effects of catastrophizing, with no significant interaction present between acceptance and catastrophizing⁴¹; however it was unknown in the literature whether an interaction existed between child acceptance and parent catastrophizing.

Based on our null acceptance-buffering model, we tested an exploratory model including parent pain acceptance. When these analyses were run, a surprising relation between parent acceptance and child catastrophizing emerged (i.e., higher parent acceptance was related to greater child catastrophizing). This prompted further testing of the CPAQ-P subscales, which revealed that parent-reported Activity Engagement predicted pediatric pain catastrophizing. This unusual finding may suggest that parents who perceive that their child is capable of engaging in activities in the presence of pain may encourage more activity than the child may be ready for, and thus be related to increased child catastrophizing. Such rationale may be consistent with the social communication model of pain emphasizing the role of intrapersonal processes in individual pain experience.⁴² Given the cross-sectional nature of the data used in this study, the relationship may become clearer through a longitudinal analysis. For example, in a study by Welkom et al., decreases in parental protectiveness over time were associated with lower levels of disability at follow-up, mediated by adolescent's pain catastrophizing.⁴³ Interestingly, the bivariate *correlations* between CPAQ-P and PCS-C were in the expected directions (i.e., inversely correlated) but then when we controlled for age and pain intensity in the fully specified model, they were positively correlated. Two possible explanations may account for this difference. First, bivariate correlations do not take into account any other potential variables that may affect the relationship, therefore covariates included in the fully specified models may have been a factor impacting these directional relations. The other possibility is that the subscales of the CPAQ-P demonstrated different relationships with the PCS-C. Specifically, pain willingness did not predict the PCS-C scores, whereas parent activity engagement was positively associated with it. It is possible that this effect was suppressed in the bivariate correlations until the subscale analysis and covariates were included simultaneously. As noted in the results, we did in fact test the interaction between age and CPAQ-P in the fully specified model, and this term was not significant.

As explained by Sturgeon and Zautra,² acceptance and catastrophizing are thought to have “opposing influences” on well-being, and may reflect a continuum of psychological flexibility. Specifically, pain catastrophizing may be conceptualized as a form of cognitive inflexibility and rigidity, which can narrow an individual's sense of engagement with the world around them. Acceptance, on the other hand, is aligned with a more flexible cognitive style that supports adaptive coping across situations. As the current study replicates previous work on the negative association between these two variables, it raises further questions about how parents' cognitive styles impact their child's adaptive or maladaptive cognitive processes. Furthermore, given that catastrophizing and acceptance are not only stable traits, but also time-varying constructs² both are known to be modifiable and responsive to intervention.

Psychological interventions such as Cognitive Behavioral Therapy (CBT) promote changing pain cognitions to be more constructive and flexible, as youth and parents who focus on unhelpful pain thoughts evidence increased pediatric pain and physical dysfunction.¹² Similarly, Acceptance and Commitment Therapy (ACT) encourages youth to think more flexibly about pain by accepting what they cannot control,⁴⁴ with research indicating reductions in pain catastrophizing⁴⁵ and increases in pain acceptance with this treatment modality.⁴⁶ Caregivers who endorse greater pain acceptance also evidence less catastrophizing,²⁰ which can foster better outcomes in their children. Mindfulness-based interventions delivered to youth with chronic pain have also demonstrated reductions in caregiver worry about their child's pain,⁴⁷ which suggests that such interventions may have the potential improve parent catastrophizing and other parental outcomes. Treatments that specifically address constructs such as catastrophizing, pain acceptance, and mindfulness might further enhance outcomes,⁴⁸ and the current study highlights the importance of addressing parent and child catastrophizing while improving pediatric pain acceptance. Furthermore, families with heightened risk may also benefit from the synergy of multifamily therapy (MFT) groups that harness CBT or ACT-based principles and tools, to foster the additional components of social learning, peer (i.e., child and parent) support, and reinforcement of coping skills⁴⁹ in ways that can protect against other risks factors.^{50, 51}

Limitations

Results highlight pain catastrophizing and pain acceptance as potent child and parent variables that predict functional outcomes, yet the current study includes limitations. First, causal interpretations cannot be made given cross-sectional data collection. As such, longitudinal testing of the relations between catastrophizing and pain acceptance, along with additional caregiver (e.g., personal chronic pain and psychiatric vulnerabilities) and pediatric (e.g., age, developmental level) factors, and the ways in which they may interact across time remains important. When alternate models were tested reversing the order of the predictors, mediators, and outcomes, we found that our identified outcomes (pain interference and mobility) did in fact predicted child PCS and CPAQ. The alternate models were not more informative than our original specified models, the latter of which were based on previous literature and theory. Given these findings, however, we cannot state conclusively that our examined model constitutes a series of uni-directional effects. This further underscores limitations in cross-sectional data, emphasizing that effects are, in essence, always bidirectional due to the correlational nature of cross-sectional data.

While helpful to gain proxy assessment of pediatric pain acceptance, another limitation of the current investigation may be that the questionnaire that assessed pain acceptance in parents (CPAQ-P) measured parents' perceptions and beliefs about their child's pain acceptance, rather than personal parental acceptance of their child's pain. Although not part of the dataset utilized for this study, a measure (i.e., Parent Pain Acceptance Questionnaire; PPAQ) exists which assesses the latter construct.³⁹ Unpublished data, however, suggests that the CPAQ-P and the PPAQ are highly correlated ($r = .807, p < 0.01$).⁵² Future research formally comparing these two measures is warranted to determine the overlap in the construct of parents' own acceptance and their perspective on their child's acceptance. One additional limitation related to measurement is the use of retrospective recall for assessing

pain over the past month, given findings that retrospective reports of pain intensity may be subject to distorted recall and inflation.⁵³ Findings underscore the general importance of caregiver involvement in multidisciplinary treatments to mitigate risk and enhance resilience, yet analyses were limited to a single caregiver, the majority of whom were mothers. Examining the role of other caregivers over time, and whether having a second caregiver in the home is protective or detrimental – particularly if/when discrepant parenting perspectives arise – might enrich understanding of contextual dynamics in the home that heighten risk or foster resilience specific to pediatric outcomes.

Conclusions and Future Directions

How resilience itself is conceptualized and subsequently measured among those managing the ongoing stress of chronic pain and their families has gained increasing attention.⁵⁴ Further exploration of additional pediatric and parent resilience factors such as positive affect and psychological flexibility⁵⁴ that may protect against the impact of unhelpful thoughts, behaviors, and other established risk factors (e.g., parent chronic pain or mental health issues) on pediatric pain outcomes is needed. Sturgeon and Zautra⁵⁵ highlight resilience as recovery from disability even in the face of risks such as catastrophizing. Goubert and Trompeter⁵⁶ posit, however, that the absence of disability or pathology does not sufficiently capture resilience, particularly as chronic pain itself serves as an ongoing stressor from which some youth cannot “recover”. They instead invite emphasis on sustainability, and pursuing optimal emotional and social well-being via engagement in valued activities that might allow for more growth than targeting risk factors alone. Perhaps most important is the critical need for additional research regarding resilience beyond recovery, and enhanced quality of life through emphasis on sustainability, pursuit of valued activities, and ability to cultivate favorable outcomes in the midst of pain. Incorporating measurement of more resilience resources and mechanisms such as social support, self-efficacy and mindfulness among youth; and psychological flexibility among their caregivers will be important in future investigations. Such research in the pediatric pain populations may be used to inform and enhance existing treatments, thereby improving quality of life for youth with chronic pain and their caregivers.

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Figure 1. Direct and indirect effects of parent pain catastrophizing on child pain interference through child pain catastrophizing. *Note:* Mobility as an outcome was not graphically depicted due to non-significant results

Figure 2. Direct and indirect effects of parent pain acceptance on child pain interference and mobility through child pain acceptance.

Figure 3.
Fully-specified model of direct and indirect effects of parent and child pain catastrophizing and pain acceptance on child pain interference and mobility.

Figure 4.

Exploratory model depicting effects of parent catastrophizing, parent pain willingness and parent activity engagement on child pain interference through child pain acceptance and child pain catastrophizing.

Table 1.**Demographic Characteristics of Adolescents and their Parents**

Demographic Variables	Adolescents	Parents
Age, M (SD)	14.72 (2.12)	45.84 (7.31)
Gender, % (N)		
Female	73.1 (237)	87.0 (282)
Male	26.9 (87)	10.8 (35)
Missing	–	2.2 (7)
Ethnicity, % (N)		
Hispanic/Latino	19.1 (62)	18.2 (59)
Non-Hispanic/Non-Latino	68.8 (223)	68.8 (223)
Missing	12.0 (39)	13.0 (42)
Racial/Ethnic Background, % (N)		
White or Caucasian	59.0 (191)	65.7 (213)
Asian	9.3 (30)	9.6 (31)
Black or African American	3.1 (10)	2.8 (9)
American Indian or Alaska Native	2.2 (7)	0.6 (2)
Native Hawaiian or Other Pacific Islander	2.5 (8)	0.9 (3)
Other	4.3 (14)	4.9 (16)
Unknown	10.2 (33)	10.8 (35)
Multiracial	9.6 (31)	4.6 (15)
Diagnoses, % (N)		–
Musculoskeletal pain	39.2 (127)	–
Abdominal pain	19.4 (63)	–
Headache	24.4 (79)	–
Complex regional pain syndrome	4.6 (15)	–
Fibromyalgia	1.5 (5)	–
Ehlers-Danlos syndrome	0.3 (1)	–
Rheumatological conditions	2.8 (9)	–
Primary psychological disorder	2.5 (8)	–
Other	4.3 (14)	–
Missing	0.9 (3)	–
Education Level, % (N)		
High school or less	–	13.5 (43)
Some college or AA degree	–	31.6 (100)
College degree (BA, BS)	–	27.8 (88)
Post-Graduate degree	–	24.4 (77)
Other	–	5.0 (16)

Note. M = mean; SD = standard deviation

Table 2.

Means, Standard Deviations and Correlations for Study Variables

Variable	N	Range	M	SD	Average Pain Intensity	Mobility Diff.	Pain Int.	PCS-C	PCS-P	CPAQ-A	CPAQ-P	CPAQ-A AE	CPAQ-A PW	CPAQ-P AE	CPAQ-P PW
1. Average Pain Intensity	323	0–10	5.95	2.16	–	.236**	.384**	.231**	.134*	-.314**	-.215**	-.300**	-.233**	-.197**	-.175**
2. Mobility Difficulties	323	39–82	62.59	7.97	–	–	.531**	.170**	.115*	-.367**	-.307**	-.322**	-.306**	-.280**	-.253**
3. Pain Interference	322	32–83	59.66	8.31	–	–	–	.456**	.258**	-.584**	-.445**	-.501**	-.503**	-.364**	-.428**
4. PCS-C	323	3–52	27.50	10.53	–	–	–	–	.426**	-.539**	-.304**	-.359**	-.595**	-.191**	-.381**
5. PCS-P	314	2–52	24.48	10.05	–	–	–	–	–	-.316**	-.419**	-.228**	-.327**	-.267**	-.519**
6. CPAQ-A	322	4–69	36.10	12.64	–	–	–	–	–	–	.618**	.890**	.821**	.562**	.512**
7. CPAQ-P	314	5–94	43.62	16.04	–	–	–	–	–	–	–	.616**	.428**	.921**	.808**
8. CPAQ-A AE	322	1–41	21.60	8.18	–	–	–	–	–	–	–	–	.471**	.613**	.430**
9. CPAQ-A PW	323	0–34	14.50	6.51	–	–	–	–	–	–	–	–	–	.323**	.455**
10. CPAQ-P AE	314	0–53	26.89	11.03	–	–	–	–	–	–	–	–	–	–	.515**
11. CPAQ-P PW	314	0–41	16.73	7.27	–	–	–	–	–	–	–	–	–	–	–

*
p < .05**
p < .01

Correlations are two-tailed. PCS = Pain Catastrophizing Scale; CPAQ = Chronic Pain Acceptance Questionnaire; AE = Activity Engagement subscale; PW = Pain Willingness subscale; Mobility Diff. = Mobility Difficulties; Pain Int. = Pain Interference.

Table 3.

Proportion of Variance Accounted for in Models 1 – 4

Model 1

Predictor	PCS-P Direct Effect	Fully Specified Model
Outcome Variable	R ² Variance	R ² Variance
PCS-C	.182	.182
Pain Interference	.067	.211

Model 2

Predictor	CPAQ-P Direct Effect	Fully Specified Model
Outcome Variable	R ² Variance	R ² Variance
CPAQ-A	.382	.382
Mobility Difficulties	.094	.160
Pain Interference	.198	.357

Model 3

Predictor	CPAQ-P Main Effect	PCS-P Main Effect	Fully Specified Model
Outcome Variable	R ² Variance	R ² Variance	R ² Variance
PCS-C	.092	.182	.201
CPAQ-A	.382	.100	.386
Mobility Difficulties	.094	.013	.167
Pain Interference	.198	.067	.349

Model 4

Predictor	CPAQ-P Pain Willingness Main Effect	CPAQ-P Activity Engagement Main Effect	PCS-P Main Effect	Fully Specified Model
Outcome Variable	R ² Variance	R ² Variance	R ² Variance	R ² Variance
PCS-C	.145	.036	.182	.389
CPAQ-A	.261	.316	.100	.383
Pain Interference	.183	.133	.067	.387