

Parental catastrophizing about child's pain and its relationship with activity restriction: the mediating role of parental distress

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ABSTRACT

Recent research has demonstrated that parental behaviors have an important impact upon child and adolescent pain outcomes. At present, however, we do not know which parents engage in particular behaviors and why. In two studies, the impact of parental catastrophizing about their child's pain upon parental tendency to stop their child's pain-inducing activity was investigated. Further, the mediating role of parental distress was explored. In study one, a sample of schoolchildren ($n=62$; $M = 12.48$ years; $SD = 1.72$) took part in a cold pressor task. In study two, a clinical sample of adolescents with chronic pain ($n=36$; $M = 15.68$ years; $SD = 1.85$) performed a 2-minute walking task (2MWT) designed as a pain-inducing activity. In both studies, the accompanying parent was asked to watch their child performing the pain task. Findings revealed, for both studies, that parents with a high level of catastrophic thinking about their child's pain experienced more distress and a greater behavioral tendency of wanting to stop their child's pain-inducing activity. Further, parental feelings of distress mediated the relationship between parental catastrophic thinking and parents' tendency to restrict child's activity. The findings are discussed in light of an affective-motivational conceptualization of pain and pain behavior.

INTRODUCTION

Pain functions to attract both our own attention [14,19,39,68,71], and other's attention [7,12,20,37,41,52], whose responses may, in turn, influence sufferer's pain [32]. This may be particularly salient in the context of pediatric pain as children and adolescents are highly dependent on parental care. Moreover, accumulating evidence indicates that parental behaviors may profoundly influence their child's pain experience [3,8,11,13,22,36,52,54,63,81,82]. Because these parental reactions are not always adaptive, it is important to understand which parents engage in particular behaviors in reaction to their child in pain, why, and what the consequences might be.

An understanding of parental behavior requires a conceptual framework taking into account the diverse components of parental responses when confronted with their child in pain. A recently formulated model on empathy in the context of pain specifies distinct but related empathic reactions by parents on cognitive (e.g., estimation of child's pain), emotional (e.g., distress) and behavioral (e.g., reassurance) levels [26]. This model also describes characteristics of the person in pain (e.g. child's pain expressions) and characteristics of the observer (e.g. parental beliefs) as having an impact upon empathic responding by the observer. In the context of pediatric pain, preliminary evidence suggests that parental catastrophic thoughts about their child's pain might be one important construct for understanding parental behaviors, in acute as well as in chronic pain [27,28]. Specifically, previous findings revealed that catastrophizing about their child's pain is related to heightened pain estimations and stronger feelings of parental distress (or self-oriented emotions) [27,30,31]. Further, evidence suggests that parental catastrophizing and feelings of distress are related to worse outcomes for their child, such as increased disability [27,31], distress and pain [31,42,46,52,53]. In contrast, parental feelings of sympathy (or other-

oriented emotions) in response to their child's pain are associated with less distress and pain [16,53].

To date, it is unclear to what extent parental catastrophizing and associated increased distress translate into specific behavioral responses. Substantial research has indicated that the interruptive function of one's own pain may become less adaptive when one catastrophizes about pain, particularly when pain has become chronic [7,14,27,31,39,40,69,73,79]. In these circumstances, pain-related fear may lead to increased avoidance behavior and thereby strongly interfere with daily functioning [38,40]. It is plausible that comparable processes take place within an interpersonal context. In line with an affective-motivational perspective upon pain [40,79], we expect that parents who catastrophize about their child's pain might primarily feel distressed and strongly engage in avoidance behavior by restricting their child's activity engagement.

Two observational studies are reported: one involving a sample of schoolchildren (study one) and a second involving a clinical sample of adolescents with chronic pain (study two). For both studies, we hypothesized that: (1) higher levels of parental catastrophizing would be associated with heightened parental distress and a greater parental tendency to stop their child's pain-inducing activity (i.e. stop tendency), and that (2) the positive association between parental catastrophizing and stop tendency would be explained (i.e. mediated) by increased levels of parental distress. Finally, given the limited data on associations among parental sympathy feelings, catastrophizing and stop tendency, we explored the relationships among these constructs.

STUDY ONE

METHOD

Participants

The participants for study one were recruited from a large sample of schoolchildren and their parents ($N = 660$) who had participated in a questionnaire study approximately one year before the start of the present study [74]. Only those children and parents who had previously given permission to be re-contacted, and who were not already contacted for another previous study [77], were considered for participation ($N = 343$ dyads). Exclusion criteria for this study included: 1) the presence of recurrent or chronic pain (i.e. pain lasting for at least three months), 2) any developmental delay, or 3) the inability of both child and/or parent to speak and write Dutch. A power analysis indicated that a sample size of 60 participants was sufficient to detect a medium effect ($d = .50$) with power .80 using $\alpha = .05$ two-tailed. Therefore, only a subsample of the 343 dyads was contacted. A weighted random sampling procedure [34] was used for the selection of participants. This random sampling procedure meant that participants were randomly selected with an equal distribution of gender and age. Ninety-one of the 343 parent child dyads were contacted, of whom 64 children and parents agreed to participate (i.e., response rate of 70.33%). The main reasons given for non-participation were lack of time, heavy work demands or having made other plans. Two children were excluded from data-analyses because they withdrew their hand before the pain task ended (i.e. 3-minute cold water task). The final sample consisted of 62 children (32 boys, 30 girls) and one of their parents (50 mothers and 12 fathers)¹. The mean age of the children was 12.48 years ($SD = 1.72$, range: 9.25 – 15.5 years). Seven children (11.3%) were recruited from the fifth grade, nine (14.5%) from the sixth grade, nine (14.5%) from the seventh grade, 14 (22.6%) from the eighth grade, 13 (21%) from the ninth grade, and 10 (16.1%) from the tenth grade. The mean age of the parents was 42.90 years ($SD = 4.33$, range: 35 – 54 years). The majority of the parents (88.3%) were married or co-habiting. About half of the parents

¹ The same sample was used for the purpose of another study (see [75]). The analyses in this article are based on other data obtained in this same sample.

(52.5%) had a higher education (beyond the age of 18 years). Most parents were employed (96.60%), others worked in the home (2.55%) or were unemployed (.85%). All children and parents were Caucasian. Ethical approval was obtained from the Ethics Committee of the Faculty of Psychology and Educational Sciences of Ghent University, Belgium. A summary of the demographic characteristics can be found in Table 1.

- Insert Table 1 about here -

Apparatus

A cold pressor task (CPT) with a water temperature of 10°C (+/- 1°C) was used to induce pain in the children. This cold pressor device has shown to be suitable for inducing pain comparable to various naturally occurring acute pains in children [67]. The cold pressor apparatus consisted of a commercially manufactured electronic cooler measuring 35 cm wide, 60 cm long, and 45 cm high. Children were instructed to lower their left hand through a round opening in the lid (12 cm by 12 cm), hold their hand just above the wrist in the cooled water and maintain this position for three minutes. The water in the tank was continuously circulated by a pump to prevent local warming. The cold pressor apparatus was placed upon a trolley adjustable in height in order to be easily adaptable to the child's height. For standardization purposes (i.e. comparable skin temperature), children were requested, prior to and after the CPT, to put their left hand in another tank filled with water maintained at 37°C (+/-1°C).

Measures

Child measures

Pain intensity. After the CPT, children were requested to provide a written report on how much pain they had experienced during the CPT. Children rated their pain by means of an 11-point numerical rating scale (NRS) from 0 ('no pain') to 10 ('a lot of pain').

Pain expression. The facial pain expression of the children during the CPT was recorded on video-tape and coded by means of the Child Facial Coding System [CFCS;4,9,24]. The CFCS is an observational rating system of 13 discrete facial actions (brow lowering, squint, eye squeeze, nose wrinkle, nasolabial furrow, cheek raiser, upper lip raise, lip corner pull, vertical mouth stretch, horizontal mouth stretch, blink, flared nostril and open lips). Three of the 13 facial actions (blink, flared nostril, open lips) are coded on presence only; i.e. absent (0) or present (1). The remaining 10 facial expressions are coded on presence and intensity (0 = no action, 1 = slight action, 2 = distinct/maximal action). All 13 facial actions were coded for every second of the three minutes cold pressor task by means of a user-friendly software program that was designed to easily view and re-view each second. One trained coder rated the facial expressions for all participants and a second trained coder independently coded a random sample of 20% of the video-tapes in order to determine the inter-rater reliability. Reliability was calculated based on the formula given by Ekman and Friesen [21], which assesses the proportion of agreement on actions recorded by the two coders relative to the total number of actions coded as occurring by each coder. The inter-rater reliabilities were acceptable for overall frequency (.77; range = .64 - .94) and for overall intensity (.70; range = .57 - .94). A total score, ranging between 0 and 414, for the facial pain expression during the 3-minute CPT was obtained by summing the scores of the 13 facial actions for every second.

Parent measures

Catastrophizing about the child's pain. To assess the parents' catastrophic thoughts about their child's pain during the CPT, a state measure of the original Pain Catastrophizing Scale for Parents was used [PCS-P;27,28]. The PCS-P consists of 13 items describing different thoughts and feelings that parents may experience when their child is in pain. Three subscales can be distinguished: rumination, magnification and helplessness. The PCS-P has

shown to be a reliable and valid instrument in a sample of parents of schoolchildren and parents of children with chronic pain [27]. In line with previous studies (see e.g. [28]); the state version of the PCS-P was composed of one adapted item from each subscale (PCS-P state; Rumination: “At this moment, to what extent do you keep thinking about how much pain your child will experience during the task?”; Magnification: “At this moment, to what extent do you think that, because of the pain, something serious might happen to your child?”; Helplessness: “At this moment, to what extent do you think, because of the pain of your child, you will not be able to endure the task?”). Prior to the child undergoing the CPT, parents were asked to rate the three items on an 11-point NRS with the endpoints 0 (= not at all) and 10 (= a lot). A mean score of these three items was calculated ranging from 0 to 10. The Cronbach’s α for the PCS-P state was high (.73).

Parental pain estimates. After the cold pressor task, parents were instructed to provide written ratings of how much pain they thought their child had experienced during the pain task. Parental pain estimates of their child’s pain were assessed using an 11-point NRS with the endpoints labelled ‘no pain’ (0) and ‘a lot of pain’ (10).

Parental distress and sympathy. After the cold pressor task, parents were asked to rate to what extent they had experienced various emotions while watching their child performing the cold pressor task. All emotion adjectives were rated on an 11-point scale ranging from ‘not at all’ (0) to ‘extremely’ (10). Based on the work of Batson [1], the list included four adjectives reflecting self-oriented emotional responses or distress (worried, upset, anxious, sad) and three adjectives reflecting other-oriented emotions or sympathy (understanding, compassionate, sympathizing). Mean parental distress scores and sympathy scores were calculated yielding two scores ranging from 0 to 10. Higher scores on both scales are indicative of higher levels of parental distress, or sympathy, respectively. The use of emotional adjectives to measure parental emotions has shown to be a reliable and valid

method [1,30]. Reliability within the present study was also high ($\alpha = .78$ for distress and $\alpha = .91$ for sympathy).

Parental stop tendency. After completion of the cold pressor task, parents were asked to report their tendency to stop their child from further engagement in the CPT (“*How much did you want to stop your child from performing the task?*”). The item was rated on an 11-point NRS ranging from 0 (= not at all) to 10 (= a lot). Higher scores indicated a higher protective tendency of parents to stop their child.

Procedure

Parents were contacted by phone by a research assistant and informed about the study purpose and procedure following a standard script. Both the child and the primary caregiver (described as the person who spent the most time with the child and took care of most of the parental chores) were invited to participate. During this call, the exclusion criteria were addressed. When parents confirmed that their child did not meet any of the exclusion criteria and parent and child agreed to participate, an appointment at the laboratory at Ghent University was made and a letter confirming their appointment was sent home.

Upon arrival at the lab, one of two experimenters explained the procedure and the aim of the study in the test-room. The cold pressor apparatus was shown and participants were told that “...we were interested in how children and their parents think and feel when the child experiences pain”. Children were told that they must “...try to endure the cold pressor task for three minutes”. Both parent and child were told that they “...could withdraw from participation at any time during the experiment for any reason”. Written informed parental consent and child assent was obtained.

After explaining the pain procedure, the second experimenter accompanied the parent to the adjacent room where the parent could observe their child. Children knew beforehand that their parent was going to observe them during the pain task. To avoid child reactivity

towards parental behaviors, children could not see their parents during the CPT. A video camera, positioned in front of the child, recorded the child's pain behavior during the pain procedure and was connected to the television screen in the observation room. The parent was able to see their child's face during the 3-minute cold pressor task and the two minutes standardization.

Prior to taking part in the cold pressor task, the child was asked to wash his/her hands and to remove jewellery or watches from the left arm/hand. The procedure, instructions and reminder of the possibility to withdraw participation were briefly repeated to the child and parent separately. After these instructions the parent was asked to complete the PCS-P-state. When the child was ready to begin with the task, the experimenter in the observation room turned the television screen on so the parent could observe their child.

A chronometer was used (1) to precisely time the length of the immersion in the warm and cold water and (2) to communicate to the child and parent the beginning and end of the warm water phase (first and second beep), and the cold water phase (third and fourth beep). The experimenter in the test room was seated on a chair behind the child in order to monitor the child's engagement in the pain task but did not talk or make eye-contact with the child during the standardization and CPT phase to minimize uncontrolled audience effects. The same was true for the experimenter in the observation room who was positioned on a chair next to the parent. After completion of the CPT, the TV screen was turned off and both parents and children were asked to report on the pain intensity the child had experienced during the CPT. Parents were also asked to complete the questionnaires assessing sympathy, distress and their stop tendency. After completion of the questionnaires, parent and child were reunited, debriefed about the purpose of the study and remunerated 25€ for their participation.

Data analysis

Statistical analyses were performed with SPSS statistical software, version 15.0 for windows. Descriptive statistics, correlation analyses and hierarchical linear regression analyses were performed to test the hypotheses two-tailed.

To test for mediation, a distinction has to be made between various effects and their corresponding weights (see Figure 1). The total effect of parental catastrophizing on parental stop tendency (weight c) consists of (1) a direct effect of parental catastrophizing on parental stop tendency (weight c') and (2) an indirect effect of parental catastrophizing on parental stop tendency through a proposed mediator, i.e. parental distress (weight ab). The effect of parental catastrophizing on parental distress is represented by weight a , whereas weight b is the effect of the parental distress on parental stop tendency, partialling out the effect of parental catastrophizing [60]. To assess this indirect effect we used a bootstrapping method (i.e. a non-parametric resampling procedure with 5000 bootstrap resamples) following the procedure described by Preacher & Hayes (2004) [25,33,55,60]. The choice for using bootstrapped confidence intervals to test the significance of the indirect effects was based on recent statistical research that suggested that bootstrapping is more appropriate than a normal-theory test (i.e., Sobel's test) for studies with smaller sample sizes [33,44,62]. Specifically, we estimated point-estimates and 90% bias-corrected bootstrapped confidence intervals. We selected the use of 90% confidence intervals because we had a specific direction in our hypothesis and by using 90% confidence intervals we narrowed down the confidence intervals to avoid type 2 errors. The percentage of the total effect that was mediated was also calculated [35].

RESULTS

Descriptive statistics

Mean scores, standard deviations and correlations between the variables are shown in Table 2. Children reported a moderate level of pain during the CPT ($M = 4.11$; $SD = 2.44$) and parental estimates of their child's pain ($M = 4.09$; $SD = 2.32$) were comparable with the ratings given by the child ($t(61) = .06$, *ns*). Parents reported a rather low level of anticipatory catastrophic thinking about the pain of their child of 2.21 ($SD = 1.48$). This is comparable with the score of the parents in the study of Goubert et al. (2009) ($t(113) = .10$, *ns*) [28]. The mean level of distress and sympathy experienced by parents was 1.49 ($SD = 1.59$) and 6.73 ($SD = 2.17$) respectively. The mean level of the tendency to stop their child during the CPT was 1.25 ($SD = 2.07$). Further, there were no significant correlations with the child's age (all $r < .13$, *ns*) and independent sample t-tests showed there were also no significant differences between boys and girls on any of the measures included.

Correlations

Of particular interest for the present study were the correlations between parental catastrophizing, distress and stop tendency. An overview of the correlations can be found in Table 2. Correlation analyses indicated that higher levels of parental catastrophic thoughts were significantly positively correlated with parental feelings of distress and tendency to have stopped their child from further engagement in the CPT. The distress experienced by the parents and their stop tendency were also significantly positively correlated with each other. Parental feelings of sympathy were significantly positively correlated with parental feelings of distress, stop tendency and estimates of their child's pain. In addition, parental pain estimates were significantly positively related to parental catastrophizing, distress and stop tendency. There were no significant correlations with the child's facial pain expression.

- Insert Table 2 about here-

Regression Analyses

Three hierarchical linear regressions were conducted to investigate the contribution of parental catastrophic thoughts in explaining (1) parental distress (2) sympathy and (3) parental stop tendency as dependent variables. In each regression analysis, the child's gender (boys coded as 0 and girls as 1) and age were entered in the first step to control for socio-demographic effects. The child's facial pain expression score was entered in the second step. Based upon previous evidence showing an association between catastrophizing and heightened pain estimations [28,64], we controlled for parental pain estimates in the third step. In the final step, parental catastrophic thoughts were entered. Results of the regression analyses are presented in Table 3. The variance-inflation factors of all regression analyses were acceptable (range: 1.04 – 1.23) suggesting that there was no problem of multicollinearity.

The relationship between parental catastrophizing and parental distress

Regression analyses indicated that there was no significant effect of the child's gender, age, facial expression and parental pain estimates. Of interest, parental anticipatory catastrophic thinking had a significant positive contribution ($\beta = .45; p < .001$), indicating that higher levels of catastrophizing contributed to higher levels of parental distress experienced during the pain of their child. Parental catastrophizing added 18% explained variance.

The relationship between parental catastrophizing and parental sympathy

Regression analyses indicated that there was no significant effect of the child's gender, age, facial expression and parental catastrophic thoughts. Only parental pain estimates had a significant contribution ($\beta = .48; p < .01$), indicating that higher estimates of their child's pain contributed to higher levels of parental sympathy experienced during observation of their child's pain. Parental pain estimates explained 20% of the variance.

The relationship between parental catastrophizing and parental stop tendency

The regression analysis with parental stop tendency as a dependent variable indicated that the child's age, gender and facial expression, as well as parental pain estimates, had no significant contribution. However, parental catastrophic thinking had a significant positive contribution ($\beta = .37; p < .01$) and explained 12% of the total 17% variance; i.e. the higher parental catastrophizing, the more they wanted to have stopped their child performing the cold water task.

-Insert Table 3 about here-

Mediation Analyses

We further investigated the mediating role of parental distress in the relationship between catastrophic thinking of parents and parental stop tendency [see Figure 1]. Catastrophizing was positively and significantly associated with parental stop tendency ($c = .19, SE = .06, p < .01$) and feelings of distress ($a = .71, SE = .16, p < .001$). With respect to the effect of the mediator, analyses showed that parental feelings of distress were positively and significantly related to parental stop tendency ($b = .21, SE = .04, p < .001$). The indirect effect ($ab = .15, SE = .07$, ie. simple mediation) was found to be significant as the bias corrected (BC) bootstrapped confidence interval (90% BC CI: .07 to .30 with 5000 resamples) excluded zero. Additional support for this mediation emerged in the finding that the direct effect of catastrophizing on parental stop tendency was non-significant ($c' = .04, SE = .05$). Parental feelings of distress accounted for 83.33% of the relationship between parental catastrophizing and stop tendency. Bootstrap analyses for sympathy as a mediator were not significant, because zero was included in the confidence interval (90% BC CI: -.01 to 0.03 with 5000 resamples)

-Insert Figure 1 about here-

DISCUSSION

In study one, the relationships between parental catastrophizing, distress, sympathy and tendency to restrict their child's activity engagement were investigated in a sample of schoolchildren and their parents. In line with our expectations, the findings revealed that parents who catastrophized more about the pain their child could experience during the experimental task, reported higher distress and also a higher tendency to stop their child in performing the pain-inducing task, as compared to low catastrophizing parents. Further, parental feelings of distress were a significant mediator of the relationship between parental catastrophizing and parental stop tendency, indicating that parents who highly catastrophize about the child's experimental pain have a tendency to stop their child's pain activity because they feel highly distressed. Parental catastrophizing was not related to parental feelings of sympathy.

These results, however, need to be interpreted with caution since the pain procedure did not elicit high levels of parental catastrophizing, distress and stop tendency. This may limit the generalization of the results to real-life situations potentially eliciting more catastrophic thoughts and distress. In addition, as the results of study one may not generalize to samples other than schoolchildren, we decided to execute a second study in a clinical sample of adolescents with chronic pain to further explore the role of parental pain catastrophizing in understanding parental emotional and behavioral reaction when faced with their child's chronic pain. Moreover, we improved our measure of parental stop tendency. Instead of relying on parental self-report after the pain experience, which may be biased by their memory of the experience, we measured actual parental stop behavior in study two.

STUDY TWO

METHOD

Participants

Adolescents suffering from chronic pain were recruited from an outpatient UK multidisciplinary Pain Management Clinic. To be eligible for participation, adolescents (1) had to be able to complete a 2-minute walk task (2MWT) alone and unassisted, and (2) were free from any significant comorbid psychiatric disorder that is contra-indicated for a Cognitive-Behavioral Therapy (CBT) approach (e.g., psychosis). Psychological distress associated with chronic pain (e.g., anxiety, depression) or common features of adolescence (e.g., mild body dysmorphism) were not exclusion criteria. In addition, adolescents and parents had to be able to speak and write English. All adolescents were accompanied by a parent or an adult primary caregiver who adopted the parenting role. Of the 42 pairs of adolescents and their primary caregiver who were approached, 39 agreed to participate, (i.e. response rate of 92.86%).² The main reason for non-participation was reluctance towards videotaping the pain task. Of those who agreed to participate, one adolescent failed to complete the 2MWT and two parents later withdrew their participation, as they did not want to see their child in distress. This resulted in a final sample of 36 adolescents (9 boys, 27 girls) and 36 parents (32 mothers, 4 fathers). The mean age of the children was 15.68 years ($SD = 1.85$, age range: 10.92 - 19.08 years), which was significantly older than the sample of schoolchildren in study one ($t(96) = -8.64, p < .001$, mean difference = -3.20 yrs). Based on an adolescent chronic pain classification scheme [45], the participating adolescents suffered from hypermobility (25%), chronic back pain (17.9%), reflex sympathetic dystrophy (21.4%) or chronic abdominal pains (14.3%). The mean duration of the pain was 46.61 months ($SD = 39.92$ months; range: 5 - 157 months). Most of the children were not attending school full-time (65.7%).

The mean age of the parents was 45.15 years ($SD = 6.00$, range: 35 – 59 years). The majority of the parents (83.3%) were married. Approximately one fifth of the parents had a

² The same sample was recruited for the purpose of another study (see [76]). The analyses in this article are based on data from this sample not previously reported.

higher education (beyond the age of 18 years). More than half of the parents were employed at the moment of the study (62.9%). Others worked in the home (28.6%), were full time carers (5.7%) or were unemployed (2.9%). Most of the children and parents were Caucasian (97.1%). A summary of the demographic characteristics can be found in Table 4.

- Insert Table 4 about here -

Pain task

Adolescents were asked to perform a 2-minute walking task (2MWT). Walking is a daily task that requires movement that is sufficient to increase pain and elicit pain behavior in chronic pain adolescents [57]. The 2MWT is suitable for measuring functional exercise capacity [65] and allows examination of the adolescent's engagement in a variety of pain behaviors. The 2MWT implied that adolescents were requested to walk as fast as possible from one marker to a second marker and back for a period of two minutes. The markers were placed on the floor, ten meters away from each other.

Measures

Adolescent's measures

Pain intensity. Pain intensity during the 2MWT was assessed using the same 11-point NRS as in study one. In addition, adolescents in this study were also instructed to complete this scale prior to performing the 2MWT (i.e. What is your current level of pain?), which was regarded as the child's baseline pain level.

Pain behavior. To be able to code the level of pain behavior afterwards, the performance of the adolescent was videotaped. A video camera was positioned at a standardized point behind the second floor marker and afforded a view of the entire face and body of the adolescent. It was not possible to make fine-grained codings in this set-up, so we could not use the CFCS as in study one. Therefore, only the key facial pain expressions as identified in the CFCS [9,24], were coded. The core facial pain grimace is characterized by

the lowering of the brow, wrinkling of the nose, raising of the cheeks, raising of the upper lips and closing or narrowing of the eyelids [56]. The facial pain grimace was coded as slightly (1) or distinctly (2) present if one of these specific facial movements was detected. To control for the difference in distance the adolescents walked, the total score on facial pain expression (summation of all codes), was divided by the number of segments coded (i.e. the number of times the adolescent walked the 10 meter distance with his/her face to the camera), resulting in a score ranging from 0 to 2. To determine inter-rater reliability [21], a single trained coder rated pain behavior for all participants and a second trained coder rated a random sample of 20% of the participants. According to the formula given by Ekman and Friesen [21] high inter-rater reliability was achieved for pain expression in the current study (.77).

Parent measures

Catastrophizing about the child's pain. Prior to watching the video, parental catastrophic thinking was assessed by means of a similar state measure as used in study 1 but now adapted for specific use in the context of the 2MWT [PCS-P,27,28]. The reliability of this state PSC-P was good ($\alpha = .71$).

Parental pain estimates. After watching the videotape of the 2MWT, parents were instructed to give written ratings on how much pain they thought their child had experienced during the pain task by means of an 11-point NRS identical to the scale used in study one.

Parental distress and sympathy. After parents had watched the videotaped 2MWT of their child, parents were asked to rate to what extent they had experienced seven proposed emotions (i.e. the same emotional adjectives as in study one) while watching their child performing the 2MWT on a 8-point scale ranging from 'not at all' (0) to 'extremely' (7). As in study one, a mean score for distress and sympathy was calculated ranging from 0 to 7 for both, with higher scores indicating higher levels of parental distress or sympathy. The

Cronbach's α for these adjectives in this study was high ($\alpha = .88$ for distress and $.91$ for sympathy).

Parental stop tendency. To measure parental protective tendency the parents were instructed to stop the videotape at the first time they would have wanted to tell their child to stop the 2MWT. When parents indicated that they wanted to stop their child, the videotape was stopped, i.e. parents did not view the remaining time of the 2MWT. The time that parents watched the video was subtracted from 120 (i.e. the normal time of the videotape was 120 seconds) to compute a new variable 'stop tendency', with higher scores (i.e. shorter times watching the tape) indicating higher levels of stop tendency.

Procedure

Adolescents and parents who entered the pain management program at the Pain Management Clinic at Bath, United Kingdom, were informed about the study and asked to participate approximately one week before the start of their program. The day they arrived at the clinic, an investigator or physiotherapist approached and provided them with an information sheet as a part of the standard assessment. During this standard assessment, i.e. consultation with a pediatric rheumatologist and a clinical psychologist, exclusion criteria were determined by means of history taking and clinical interview. Parents were informed about the aim of the study (i.e., investigating the impact of adolescent's pain upon the experience of parents) and reassured that non-participation would have no influence on their treatment. Both adolescents and parents were also informed that the accompanying parent or primary caregiver would be asked to watch the videotape of the adolescent performing the 2MWT.

When adolescents and parents wished to participate, a written informed consent was obtained from the adolescent as well as from the parent. Performing the 2MWT and completing a battery of self-report questionnaires before entering the program is part of the

standard assessment procedure. Videotaping the 2MWT was only done for adolescents participating in the study. Before performing the 2MWT, adolescents were requested to rate their current level of pain and were instructed to walk as fast as possible from one marker on the floor to the other marker ten meters away. During the 2MWT, the adolescents were given standard instructions to facilitate the adolescent to complete the task to their maximum capability (at 30 seconds: ‘as fast as you can’, at 1 minute: ‘1 minute gone, 1 minute to go’, at 1 minute 30 seconds: ‘only 30 seconds left’ and at 2 minutes: ‘stop, well done’). Adolescents were only given minimal information about the pain behaviors being coded in order to reduce the reactivity of pain behavior observation. After the completion of the 2MWT adolescents were instructed to rate their level of pain experienced while performing the task.

Shortly after the adolescent had performed the 2MWT, the parent was asked to watch, in a separate room, the videotape of their child performing the 2MWT. Parents were also instructed to complete several questions both before (PCS-P) and after (pain estimation and emotional adjectives) watching the videotape.

RESULTS

Descriptive statistics

Mean scores, standard deviations and correlations between the variables are shown in Table 5. The mean distance walked by the adolescents was 112.14 metres ($SD = 53.66$, range: 10 - 200), which was lower in comparison with the performance of healthy children and adolescents [23]. Adolescents reported a significant increase in pain during the 2MWT ($t(35) = -4.74, p < .001$) in comparison with their pain reported before the task ($M = 6.72, SD = 1.86$, range: 3 - 10). The level of pain adolescents reported during the task was significantly higher than the pain reported by the schoolchildren in study one, who performed the CPT ($t(96) = -7.21, p < .001$). Parent estimates of their child’s pain during the 2MWT were

significantly lower in comparison with the ratings given by the adolescents ($t(34) = 3.77, p < .001$). The mean level of parental catastrophic thinking about the pain of their child was 1.92 ($SD = 2.00$). This level of catastrophizing is comparable with levels of parental catastrophizing obtained in study one, where parents observed their child performing a CPT ($t(96) = .83, ns$) and with levels of parental catastrophizing in a study of Goubert et al. (2009) ($t(87) = -.65, ns$), where parents viewed their child performing a pressure pain test [28]. The mean level of distress experienced by parents was 2.28 ($SD = 1.95$). This score is significantly higher in comparison with study one ($t(96) = -3.99, p < .001$). The mean level of sympathy experienced by the parents was 3.77 ($SD = 2.23$), which is significantly lower than the level of sympathy experienced by the parents in study one ($t(96) = 2.48, p < .05$). The mean level of stop tendency of the parents was 23.58 ($SD = 36.92$). In addition, the adolescent's age was not significantly correlated with any of the measures (all $r < .22, ns$). Independent sample t-tests indicated no significant differences between boys and girls, except for parental pain estimates ($t(60) = -2.00, p = .05$) which were significantly higher for girls ($M = 4.68, SD = 2.03$) than for boys ($M = 3.53, SD = 2.46$).

Correlations

Of interest for the present study are the correlations between parental catastrophizing, distress and parental tendency to stop their child (see Table 5). Correlation analyses indicated that parental catastrophizing about their child's pain was significantly correlated with parental distress and stop tendency. Specifically, findings indicated that parents with higher levels of catastrophic thoughts experienced higher levels of distress and demonstrated a greater tendency to stop their child in performing the 2MWT. The distress experienced by the parents and stop tendency were also significantly and positively correlated, indicating that parents who experienced higher levels of distress while watching the videotape of their child reported

a greater tendency to stop their child in their performance of the 2MWT. Parental feelings of sympathy showed a positive correlation with parental feelings of distress, catastrophic thoughts, stop tendency and pain estimates. Parental pain estimates showed a significant positive correlation with parental feelings of distress and reported pain by the child.

- Insert Table 5 about here-

Regression Analyses

A series of regression analyses, similar to study one, were performed to investigate the contribution of parental catastrophic thinking about their child's pain in explaining (1) parental distress, (2) parental sympathy and (3) parental stop tendency. Specifically, in each analysis, the adolescent's gender (coded as 0 = boys and 1 = girls) and age were entered in the first step to control for possible socio-demographic effects. In the second step of the analysis, 'pain duration' was entered to control for the time the adolescent was suffering from chronic pain. To control for the amount of pain the adolescent expressed during the 2MWT the facial pain expression of the adolescent was entered in the third step. Parental estimates of their child's pain were entered in the fourth step. In the final step, parental catastrophizing about their child's pain was entered. Results of these regression analyses are presented in Table 6. The variance-inflation factors of both analyses were acceptable (range: 1.16 – 1.35) suggesting that there was no problem of multicollinearity.

The relationship between parental catastrophizing and parental distress

The regression analysis indicated that there was no significant effect of gender, age, pain duration and facial expression of the adolescent. An interesting finding was the significant contribution of parental catastrophic thoughts ($\beta = .43$; $p < .01$; adding 16% explained variance) and parental pain estimates ($\beta = .42$; $p < .05$; accounting for 27%

explained variance), indicating that higher levels of parental catastrophizing and pain estimations contributed to higher levels of parental distress.

The relationship between parental catastrophizing and parental sympathy

The analysis indicated that there was no significant effect of adolescent's gender, age, pain duration, facial expression or parental catastrophic thoughts. Only the contribution of parental pain estimates was significant ($\beta = .73$; $p < .001$), indicating that higher estimates of their child's pain were related to higher levels of parental sympathy. Parental pain estimates explained 54% of the variance.

The relationship between parental catastrophizing and parental stop tendency

In the regression analysis with parental stop tendency as dependent variable, the age, gender, pain duration, facial expression of the adolescent and parental pain estimates did not contribute significantly in explaining the tendency of parents to stop their child. Parental catastrophic thoughts had a significant positive contribution ($\beta = .46$; $p < .05$): parents with more catastrophic thoughts showed a higher tendency to stop their child. Parental catastrophic thoughts added 18% explained variance.

- Insert Table 6 about here-

Mediation Analyses

As in study one, we also investigated the mediating role of parental feelings of distress in the relationship between parental catastrophic thinking and stop tendency [see Figure 1]. Similar results to those in study one were found: 1) catastrophizing showed a positive and significant association with parental stop tendency ($c = 2.73$, $SE = .94$, $p < .01$) and distress feelings ($a = .70$, $SE = .19$, $p < .001$); 2) parental feelings of distress showed a positive trend with parental stop tendency ($b = 1.58$, $SE = .83$, $p = .07$) and 3) the indirect effect ($ab = 1.11$, $SE = .89$, ie. simple mediation) was found to be significant as the bias corrected (BC) bootstrapped confidence interval (90% BC CI: .12 to 3.01 with 5000 resamples) excluded

zero. In addition to support this mediation the direct effect of catastrophizing on parental stop tendency was found to be non-significant ($c' = 1.62$, $SE = 1.08$). Parental feelings of distress accounted for 40.81% of the relation between catastrophizing and stop tendency. Bootstrap analyses for sympathy as mediator were not significant, as zero was included in the confidence interval (90% BC CI: $-.08$ to 1.94 with 5000 resamples).

DISCUSSION

In comparison with study one, parents of adolescents with chronic pain reported similar levels of catastrophizing about their child's experimental pain, but experienced more distress and less feelings of sympathy when observing their child in pain. In addition, the adolescents of study two were significantly older than the schoolchildren who participated in study one. Despite these differences, the pattern of results was similar to study one: parental catastrophic thoughts about their child's pain during the experimental task contributed significantly and positively to their experienced level of distress and tendency to stop their child's pain inducing activity. Parental feelings of distress also mediated the relationship between catastrophic thoughts and the tendency to stop their child performing the pain task.

GENERAL DISCUSSION

The pattern of results was comparable for both studies and can be readily summarized. First, parental catastrophic thoughts about their child's pain during the pain tasks contributed to heightened feelings of parental distress, but not to heightened feelings of sympathy. Second, parental catastrophic thoughts were associated with a higher tendency of parents to stop their child performing the pain-inducing activity. Third, parental feelings of distress mediated the relationship between catastrophic thoughts and parental stop tendency. There was no mediating role for parental feelings of sympathy. Moreover, in both studies, child pain

behavior was not related to parental emotional and behavioral reactions towards their child in pain.

The present findings are consistent with previous research in samples of parents of schoolchildren [27,30], parents of adolescents with chronic pain [27] and couples [6,41] that show positive associations between catastrophizing about their child's or partner's pain and observer's feelings of distress. Moreover, the current findings extend the earlier results in several ways. In particular, and to the best of our knowledge, this is the first study that investigated *how* catastrophic thoughts translate into parental behavioral response tendencies (i.e. heightened tendency to restrict their child's activity engagement) and which factors influence this relationship (i.e. mediation by heightened levels of parental distress).

The findings of the present study might be interpreted in light of an affective-motivational perspective. Pain has been conceptualized as an urge to escape [19], particularly when pain is perceived as highly threatening [40,79]. The present findings suggest that similar processes might be at play in an interpersonal context of pain. In particular, the more threatening parents perceived their child's experimental pain, the higher their tendency to stop their child's pain-inducing activity. As previous research suggested that parental activity-restricting behaviors are related to higher distress, somatic complaints and functional disability in children and adolescents [8,11,13,31,36,42,52,54,63,81,82], the current findings may have important clinical implications, in that they suggest that particularly high catastrophizing parents might be most likely to engage in behaviors that restrict child activity engagement. Importantly, this response may have adaptive value as it may protect the child from further harm or pain. However, in chronic pediatric pain, longstanding avoidance of daily activities, (e.g. going to school or playing with friends), may contribute to increased disability and maintain or exacerbate the pain problem [7,18,27,31,40,73,79].

An affective-motivational understanding of the present findings could be further elaborated with previous research on empathic emotional responses in the context of helping behavior, which may also provide important pathways for future research. Specifically, it has been shown that feelings of distress towards another person are related to an egotistic or self-oriented motivation of helping the other person in pain in order to reduce their own level of distress. Feelings of sympathy on the other hand are associated with an altruistic or other-oriented motivation, i.e. the behavioral tendency to help another person by concern for the other [1,10,15]. Furthermore, Yamada & Decety (2009) found that when one observes another in pain a threat-detection system is automatically initiated, signalling a potential threat in the environment thereby activating self-orientated emotions and escape tendencies. An empathy sharing response is not immediately observed. This suggests that feelings of distress and associated escape and avoidance tendencies may be automatically activated when perceiving someone else in pain, and that feelings of sympathy only occur in a second phase, after adequate regulation of distress [29,83]. In the context of pediatric pain, parental feelings of distress seem to be related to more pain and distress in children and adolescents; feelings of sympathy have been found to be related to more supportive parenting and better child outcomes [16,42,52,53]. Based on our finding that parental distress and not parental feelings of sympathy mediated the relation between parental catastrophizing about their child's pain during the task and parent's tendency to restrict child's activity engagement, it is reasonable to assume that parents with catastrophic thoughts have a preference for limiting their child's pain-inducing activity primarily because it functions as a way to reduce their own feelings of distress. Accordingly, parental activity-restricting tendencies might be considered as a strategy to reduce or escape the distressing experience (i.e. their child's pain). This would imply that those parents can be taught strategies to regulate their distress when faced with their child in pain in order to allow feelings of sympathy and adaptive helping behaviors

[29,30,72]. This could be particularly important in the context of chronic pain, as we found that parents of adolescents with chronic pain (i.e. parents of study two) experienced more distress than parents of schoolchildren (i.e. parents of study one). However, future studies are needed to assess parental motivation (i.e. altruistic or egoistic) to engage in avoidance behavior by restricting child's activity engagement. In addition, as both studies involved a controlled experimental task within a safe experimental context, generalization of these results to uncontrolled real-time situations may be limited.

A number of limitations to these studies need to be considered, each of which point to new directions for research. First, because the sample size was small in both studies, especially in study two, only large effects could be detected. Also, the pain procedures did not provoke high levels of parental catastrophizing, distress and stop tendency, which may limit generalization of the results. Replication of these findings with larger samples and in other settings is necessary. Second, the present findings were based on cross-sectional data, hence do not indicate causal effects. Longitudinal studies are needed to investigate the direction of the relation between catastrophizing and distress. Third, some of the small differences between study one and two may be due to differences in the pain induction task as well as the use of a different measure for parental stop tendency. Moreover, in study two, more girls participated, parents were less educated and the adolescents were significantly older than the participants in study one. In spite of these differences, the results were largely consistent, attesting to the robustness of the findings. Fourth, mothers' responses may differ from those of fathers [30,50]. Since the majority of participating parents were mothers, the present studies did not allow investigation of mother-father differences and results are limited to maternal responses. Further studies are needed to investigate whether similar patterns are true for fathers. Fifth, we used a state measure of catastrophizing assessing parental catastrophic thoughts related to the experimental situation. Although a recent study showed that state

measures of catastrophizing might be more accurate and relevant than dispositional measures [5], generalization to other pain situations is limited. Nevertheless, as our results are comparable with findings from previous studies investigating catastrophic thoughts about their child's pain in general [27,30], it is reasonable to assume that our state measure of catastrophizing might reflect a more general trait of parents to catastrophize about their child's pain. Sixth, only action tendencies were measured, and not actual behaviors. Accordingly, other methodologies might be useful, including observational designs [2] and ecological momentary assessment [13] to gain further insight into actual parental responses towards their child's pain. Finally, the observed relationships between parental catastrophizing, distress, and stop tendency might have been affected by moderating variables [e.g., parental history of pain, characteristics of the parent-child relationship; 51,66], not assessed in the present studies. For example, the relationship between catastrophizing, distress, and stop tendency might be particularly strong in parents who are in general overprotective towards their child [17,36,42,43] and in parents with a history of chronic pain [7,61].

Furthermore, motivational theories can help direct further investigation of understanding parental behavior towards their child in pain. Protecting their child from further harm or pain by restricting the child's activity engagement might be only one of multiple goals parents have when faced with their child in pain. In fact, motivational theories [58,59,68,70] suggest that individuals pursue multiple, potentially conflicting, goals. In the context of chronic pain, it is assumed that disengaging from unattainable pain-relief goals in order to engage in other attainable life-goals, despite the pain, is associated with better well-being [39,47,48,49,58,78]. Attentional processes might be particularly important in understanding the regulation of these multiple goals. Specifically, previous research has shown that, when trying to control pain becomes the most important goal, attention to events

relevant for this pain-related goal may hinder the pursuit of other important goals [71,80]. However, to our knowledge, no studies have investigated the regulation of multiple goals in an interpersonal context. When confronted with their child in pain, parents might be confronted with two types of goals. On the one hand, goals aimed at controlling or avoiding the child's pain and, on the other, goals related to other domains of the child's functioning (e.g. social or academic development). It is plausible that effective parenting in the context of pain might be dependent upon successful regulation of these possible conflicting goals. In future studies, it would be interesting to investigate the influence of parental catastrophic thinking about their child's pain on their conflicting goals when facing their child in pain, as we could assume that this goal conflict may be especially salient for catastrophizing parents [38].

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FIGURE LEGENDS

Figure 1: Graphic representation of the mediation model. Note. The total effect (weight c) consists of a direct effect (weight c') and the indirect effect (ab weight).

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Table 1

Demographic characteristics of study one.

	%	M	SD
Age child (years)		12.48	1.72
Gender child (% Females)	48.39		
Pain duration		N/A	N/A
Age parents		42.90	4.33
Gender parents (% Mothers)	80.65		
Higher education parents	52.50		

Table 2

Means (M), Standard deviations (SD) and Pearson correlation coefficients for all parent measures in Study 1.

	N	M	SD	Range	2	3	4	5	6	7
1 Parental distress	62	1.50	1.59	0 – 8.25	.32*	.50**	.69**	.19	-.00	.35**
2 Parental sympathy	62	6.73	2.17	1-10	-	.10	.27*	-.01	-.13	.43**
3 PCS-P state	62	2.21	1.48	0 - 7		-	.40**	.08	.08	.29*
4 Parental stop tendency	62	1.25	2.07	0 - 10			-	.05	-.17	.22
5 Child's facial pain expression	62	24.45	28.20	2.41 - 193.68				-	.17	.23
6 Child's experienced pain – child report	62	4.11	2.44	0 - 9					-	.16
7 Parental pain estimates	62	4.09	2.32	0 - 8						-

* $p < .05$, ** $p < .01$; PCS-P state = state version of Pain Catastrophizing Scale for Parents

Table 3

Hierarchical regression analysis explaining parental distress and stop tendency in Study 1. Standardized betas from the last step in the analyses are displayed.

Criterion variable	Step	Predictor	Beta	ΔR^2	Adj. R^2
Parental distress	1	Child's age	-.04	.03	-.01
		Child's gender	.12		
	2	Child's facial pain expression	.09	.03	.00
	3	Parental pain estimates	.16	.08*	.08
Parental sympathy	1	Child's age	.00	.00	-.03
		Gender	-.05		
	2	Child's facial pain expression	-.11	.00	-.05
	3	Parental pain estimates	.48**	.20***	.14
Parental stop tendency	1	Child's age	-.04	.00	-.03
		Gender	.03		
	2	Child's facial pain expression	-.02	.00	-.05
	3	Parental pain estimates	.11	.05	-.02
	4	PCS-P state	.37**	.13**	.10

* $p < .05$, ** $p < .01$, *** $p < .001$; PCS-P state = state version of Pain Catastrophizing Scale for Parents

Table 4

Demographic characteristics of study two.

	%	M	SD
Age child (years)		15.68	1.85
Gender child (% Females)	75.00		
Pain duration		46.61	39.92
Age parents		45.15	6.00
Gender parents (% Mothers)	88.89		
Higher education parents	17.10		

Table 5

Means (M), Standard deviations (SD) and Pearson correlation coefficients for all parent measures in Study 2.

	N	M	SD	Range	2	3	4	5	6	7	8
1 Parental distress	36	2.28	1.95	0 – 6.67	.81**	.54**	.48**	-.04	-.26	.06	.55**
2 Parental sympathy	36	3.77	2.23	0 - 7	-	.37*	.43**	.14	-.22	.27	.77**
3 PCS-P state	36	1.92	2.00	0 – 6.25		-	.44**	-.05	-.02	.10	.27
4 Stop tendency	36	23.58	36.92	0 - 112			-	.12	.03	.08	.27
5 Child's facial pain expression	36	.31	.55	0 - 2				-	-.17	.38*	.23
6 Pain duration	36	46.61	39.92	5 - 157					-	-.28	-.33
7 Child's experienced pain – child report	36	7.44	1.73	4 - 10						-	.54**
8 Parental pain estimates	36	5.74	3.14	0 - 10							-

** $p < .01$; PCS-P state = state version of Pain Catastrophizing Scale for Parents

Table 6: Hierarchical regression analysis explaining parental distress and stop tendency in Study 2. Standardized betas from the last step in the analyses are displayed.

Criterion variable	Step	Predictor	Beta	ΔR^2	Adj. R^2
Parental distress	1	Child's age	-.04	.02	-.04
		Child's gender	-.03		
	2	Pain duration	-.13	.05	-.02
	3	Child's facial pain expression	-.12	.00	-.06
	4	Parental pain estimates	.42*	.27**	.22
Parental sympathy	1	Child's age	-.12	.01	-.05
		Child's gender	-.06		
	2	Pain duration	.04	.04	-.04
	3	Child's facial pain expression	-.01	.01	-.07
	4	Parental pain estimates	.73***	.54***	.53
Parental stop tendency	1	Child's age	.04	.03	-.03
		Child's gender	-.27		
	2	Pain duration	-.08	.01	-.05
	3	Child's facial pain expression	-.02	.00	-.08
	4	Parental pain estimates	.14	.07	-.04
	5	PCS-P state	.46*	.18*	.14

* $p < .05$, ** $p < .01$, *** $p < .001$; PCS-P state = state version of Pain Catastrophizing Scale for Parents