Children's catastrophic thinking about their pain predicts pain and disability six months later.

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ABSTRACT

Catastrophic thinking about pain has been identified as an important determinant of adjustment to pain, in both adults and children. No study has investigated the prospective and unique role of catastrophizing in explaining later pain and disability in children. The aim of the present study was to investigate the prospective roles of catastrophic thinking about pain, pain intensity, and trait anxiety and their putative relationship with pain and disability tested six months later. Participants were 323 schoolchildren. Analyses revealed that the child's pain catastrophizing at baseline had a small but unique contribution to the prediction of pain and disability 6 months later, even when controlling for the initial pain and disability levels. In line with expectations, moderation analyses revealed that the effects of catastrophizing upon pain and disability at follow-up were only true for those children reporting low levels intensity of pain at baseline. The variability in disability and pain complaint could not be explained by trait anxiety. Instead anxious disposition might be best conceived of as a precursor of catastrophizing in children; i.e. children with higher levels of trait anxiety at baseline were more inclined to report higher levels of catastrophizing at follow-up. The findings are discussed in terms of potential mechanisms through which catastrophizing might exert its negative impact upon pain and disability outcomes in children.

1. INTRODUCTION

Children frequently experience pain (Perquin et al., 2000) Most of these experiences are not disabling and go unreported or unnoticed. For a minority of children, however, the repeated experience of pain substantially impairs physical, social and psychological functioning (Kashikar-Zuck et al., 2001). Although pain intensity has been shown to be important in understanding disability in children (Claar and Walker, 2006), other factors, above and beyond pain intensity, may constitute a risk factor for the maintenance of pain and disability. In particular, pain catastrophizing, defined as an exaggerated negative orientation toward actual and anticipated painful stimuli (Sullivan et al., 1995; 2001), has emerged as a salient determinant of adjustment to pain in both adults (Sullivan et al., 2001) and children (Vervoort et al., 2006).

Despite research reporting an increased association between pain catastrophizing and poor outcomes such as increased pain and disability (Sullivan et al., 1995), several issues remain unaddressed. First, the majority of studies investigating the role of catastrophizing are cross-sectional in design (see e.g. Sullivan et al., 1998). Second, although it is known that catastrophically appraising threat emerges early in life (Brown et al., 1986), no study has investigated the prospective role of catastrophizing in children, and its potential risks of fuelling or maintaining later pain and disability. Third, it is known that the specific effects of pain catastrophizing have a general relationship with other distress-related variables such as trait anxiety, defined as an enduring pattern of automatic negative appraisal (Sullivan et al., 2001). Disentangling the effects of catastrophizing and trait anxiety is of theoretical and clinical interest. It has been suggested that an anxious disposition has no direct effect upon pain and disability, but might best be conceived of as a precursor of catastrophizing (Goubert et al., 2004). To date, prospective data on the relative importance of trait anxiety versus catastrophizing are lacking.

There were three objectives of this study. First, we investigated whether, in a sample of school children, catastrophizing measured at baseline (time 1) positively contributes to the prediction of pain and disability measured six months later (time 2). Second, given the significant role of pain intensity for pain and disability outcomes (Claar and Walker, 2006), we investigated whether the relationship between catastrophizing (time 1) and pain and disability (time 2) holds for different levels of pain (time 1). Given that high-intensity pain in itself is less likely to go unnoticed for everyone, and therefore more likely to interfere with daily functioning (Eccleston and Crombez, 1999), the effects of catastrophizing may become most pronounced at lower pain intensities. As such, we hypothesized that catastrophizing at time 1 might be a vulnerability factor for (1) the increase of pain and (2) disability at time 2, in particular when pain at time 1 is low. Third, in order to explore the conceptual utility and distinctiveness of catastrophizing, we hypothesized that trait anxiety will not account for the effects of catastrophizing. Instead, we expect that the child's anxious disposition might be conceived of as a precursor of pain catastrophizing.

2. METHOD

2.1. Participants

Following approval from the ethics committee of the Faculty of Psychology and Educational Sciences of Ghent University, twenty-three high schools (grades 4 through 9) were contacted for the assessment at Time 1. Eleven schools agreed to participate, yielding a potential sample of 2016 children. Parental informed consent and child assent were obtained for 1376 children, and 1373 children returning completed questionnaires (response rate = 68.11%; 673 boys, 700 girls). Of the 1373, 492 consented to be re-contacted and were approached six months later for the Time 2 assessment. Three hundred and sixty eight children (n = 368; 171 boys, 197 girls), 74.80% of the sample re-contacted, returned

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completed questionnaires. The final sample for which complete data were available consisted of 323 children: invalid composite scores (more than 25% of the items of a given questionnaire not answered) were coded as missing values. There were no other exclusion criteria specified. Drop-out analyses showed that there were no significant differences on socio-demographic and other variables included in this study as rated in the baseline study (n = 1373), children entering the study (n = 323), those who did not consent to be re-contacted (n = 881) or did not later respond (n = 124). The mean age of the sample of children was 12.32 years (SD = 1.44 years, range 9.58 years to 15.59 years). In terms of school grades, 15.2 percent of the children (n = 49) were recruited from the fourth grade, 19.5% (n = 63) from the fifth grade, 14.9% (n = 48) from the sixth grade, 34.4% (n = 111) from the seventh grade, and 10.8% (n = 35) from the eight grade, and 5.3% (n = 17) from the ninth grade. The majority of the children were Caucasian (98.8%). Approximately 85% of the children lived in a family whose parents were married or co-habiting.

2.2. Procedure

Schools were contacted first by letter, then by phone or a visit. After consent was obtained from the school director for this study to take place, teachers and parents were sent a letter explaining the purpose of the study. Participants were explained that we were interested in how they experience pain. Written informed parental consent, and child assent, was obtained. Questionnaires for the assessment at baseline (time 1) were administered to the children during regular school hours. Time 1 assessment took place about the end of the school year (April-May). Parent questionnaires and parent consent form giving permission for further contact at the 6 month follow-up period (time 2) were sent home with the child. Parents completing the time 1 assessments returned the questionnaires and consent form by mail. Three weeks after time 1 assessment a letter was sent home with all children to remind the parents to fill out the questionnaires and consent form, if not already done, and to return

them by mail. For the assessment at time 2 (6 months later; i.e. October - November), parent and child questionnaires were sent home and returned by mail. A reminder letter to participate was sent home to those parents and children who did not reply within 3 weeks. For the present study, only questionnaires administered to the child were used.

2.3. Instruments

Participants completed a battery of questionnaires assessing pain catastrophizing, pain intensity, functional disability and trait anxiety. Trait anxiety was assessed only at time 1. Pain intensity, functional disability and pain catastrophizing were assessed both at time 1 and time 2 (6-months later).

Catastrophic thinking about pain was assessed with the Dutch version of the *Pain Catastrophizing Scale for Children* (PCS-C; Crombez et al., 2003). This instrument is an adaptation of the adult Pain Catastrophizing Scale (Sullivan et al., 1995). The PCS-C consists of 13 items describing different thoughts and feelings that children may experience when they were in pain. Children rate how frequently they experience each of the thoughts and feelings when they are in pain using a 5-point scale (0 ='not at all', 4 ='extremely'). The PCS-C yields a total score that can range from 0 to 52, and three subscale scores for rumination (e.g. 'when I have pain, I can't keep it out of my mind'), magnification (e.g. 'When I have pain, I keep thinking of other painful events') and helplessness (e.g. ' When I have pain, there is nothing I can do to reduce the pain'). The PCS-C has been shown to be both reliable and valid with children aged from 9 to 15 years (Crombez et al., 2003) and showed high internal consistency in the present sample (α = .88 at time 1; .86 at time 2).

Pain intensity was assessed on a 0- to 100 mm Visual Analogue Scale (VAS; 0 = 'no pain', 100 = 'a lot of pain''. The participants were asked to rate their 'present' and 'highest' pain intensity in the past two weeks. The mean score of 'present pain intensity' and 'highest

pain intensity' was calculated as an index of pain severity. Further, frequency of pain episodes (0 = 'none', 4 = 'constant') during the last two weeks was assessed.

Trait anxiety was assessed by the Trait version of the Dutch version *State-Trait Anxiety Inventory for Children* (STAIC-trait; Spielberger et al., 1973; Bakker et al., 1989). The STAIC-trait is a 20-item questionnaire designed to measure the disposition in children to interpret situations in a threatening way (e.g. 'I notice my heart beats fast'). Participants are asked to use a 3-point scale to indicate how often each statement is true of them ('hardly ever', 'sometimes' or 'often'). Total scores can range from 0 to 40. The STAIC has been shown to be a reliable and valid instrument in previous research (STAIC-trait; Spielberger et al., 1973; Bakker et al., 1989) and showed high internal consistency in the present sample (α = .88).

Functional disability was assessed with the Dutch version of the *Functional Disability Inventory* (FDI; Walker and Greene, 1991; Crombez et al., 2003). The FDI is a self-report inventory for children that measures perceived difficulty, due to somatic symptoms, in performing a number of activities in the domains of school, home, recreation, and social interactions (e.g. 'being at school all day'). It consists of 15 items to be rated on a 5-point scale (0 to 4), and yields total scores that can range from 0 to 60. The reliability and validity of the FDI has been demonstrated in previous research (Walker and Greene, 1991; Claar and Walker, 2006). Cronbach's alpha of .84, respectively .88 in the present sample indicated high reliability at time 1 and time 2 assessment.

3. RESULTS

3.1 Statistical analyses

Correlational and regression analyses (using SPSS 15.0) were performed to examine the expected prospective associations between pain catastrophizing, trait anxiety, pain, and

functional disability. Given we had a priori hypotheses about the direction of effects, one-tailed tests of significance (p < .05) were used.

3.2 Descriptive statistics

Mean scores, standard deviations, and Cronbach's α coefficients for all measures at Time 1 and at Time 2 (6 month follow up) are presented in Table 1. The mean levels of catastrophic thinking about pain at Time 1 (M = 12.65, SD = 8.10; range 0-40) and Time 2 (M = 11.48, SD = 7.11; range 0-39) were comparable with the mean levels reported in another sample of school children (Vervoort et al., 2006). The Time 1 measure of catastrophizing was significantly higher than the level of catastrophizing at Time 2 (t(362) = 2.73, p<.01). Children reported similar levels of pain severity on the VAS, compared with other samples of school children (Vervoort et al., 2008). The mean ratings were 16.17 (SD = 22.75; range 0-100) for the present pain level at Time 1, and 12.14 (SD = 19.04; range 0-78) at Time 2, and 42.85 (SD = 30.26; range 0-100) for the highest pain level in the past two weeks at Time 1, and 35.78 (SD = 30.79; range 0-100) at Time 2. The mean pain intensity at Time 1 (M = 29.51, SD = 23.32; range 0-100) was significantly higher than the mean pain intensity at Time 2 (M = 23.96, SD = 22.40; range 0-87.5; t(367) = 3.69, p<.0001). The majority of the school children (78.5% at Time 1 and 65.8 % at Time 2) reported at least one pain experience in the past two weeks. Of these children, 23.1% at Time 1 and 20.1 % at Time 2 reported having experienced pain 'only once', 42.7% at Time 1 and 35.9% at Time 2 reported experiencing pain 'sometimes', 10.1% at Time 1 and 9% at Time 2 reported having experienced pain 'often' and 2.2% at Time 1 and 0.8% at Time 2 reported experiencing 'constant' pain. The most frequent pain complaints were pain in the legs (35% at time 1 and 31% at time 2), headaches (23% at time 1 and 18% at time 2), and stomach ache (19% at time 1 and 13% at time 2). Mean functional disability at Time 1 (M = 6.62, SD = 6.53; range 0-35) and Time 2 (M = 5.27, SD = 6.57; range 0-44) was lower than the mean level reported in a sample of

children with chronic pain (Crombez et al., 2003; Claar and Walker, 2006). Time 1 level of functional disability was significantly lower than the mean level of functional disability at Time 2 $(t(333) = 3.51, p<.005)$[1]. The level of trait anxiety $(M = 13.22, SD = 7.36;$ range 0-39) at Time 1 was lower than the mean level reported in a sample of children with chronic pain (Vervoort et al., 2006).

3.3 Correlations

All correlations between variables were significantly positive, varying between .11 and .48 (see also Table 1). Correlation coefficients were higher between constructs measured at the same time, as compared to correlation coefficients between Time 1 and Time 2 measures. Of particular interest for this study were the correlations between pain catastrophizing at Time 1 and the measurements six months later. As expected, analyses revealed significant correlations between pain catastrophizing at Time 1 and pain intensity and functional disability at Time 2. Of further interest, the test-retest correlation coefficient of catastrophizing measured at Time 1 and Time 2 was significantly positive (.42), but low compared to findings in adult clinical populations in which test-retest correlation coefficients about .80 have been reported over a six month period (see e.g. Keefe et al., 1989).

-   Insert Table 1 about here –

3.4 Value of catastrophizing in predicting pain intensity at six months and the moderating role of pain intensity

A hierarchical regression analysis was performed to investigate the contribution of the child's catastrophizing (Time 1) in predicting pain intensity at six months (Time 2) (see Table 2). In addition, we investigated to what extent baseline pain intensity (Time 1) moderates this relationship. To test for pain intensity (Time 1) as a moderator, it is necessary to enter the cross-product terms of pain intensity (Time 1) and pain catastrophizing (Time 1) in a separate

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[1] The time of measurement may be a possible explanation for the general lower levels of pain, catastrophizing and disability at time 2 than at time 1, with higher levels of pain, catastrophizing and disability being more likely at the end of the school year than at the beginning of the school year.

block in the hierarchical regression analysis, following the entry of pain intensity (Time 1) and pain catastrophizing (Time 1) as first-order terms (Baron and Kenny, 1986). To reduce the effects of multicollinearity, continuous variables were centered (Aiken and West, 1991). In the first step, the child's sex (boys coded as 0, girls coded as 1) and age were entered to control for possible effects of sociodemographic variables. To investigate the unique effects of pain catastrophizing, beyond the child's trait anxiety, the child's level of trait anxiety (Time 1) was entered in the second step. In the third step, the child's pain intensity (Time 1) and pain catastrophizing (Time 1) were entered. In the final step, the interaction term between pain intensity (Time 1) and pain catastrophizing (Time 1) was entered. Variance-inflation factors were acceptable (range 1.04-1.56), suggesting that there was no problem of multicollinearity. Statistically significant interactions were interpreted by plotting regression lines for high and low values of the moderator variable (Aiken and West, 1991; Holmbeck, 2002).

Analyses revealed a significant main effect for age ($\beta = .11$, $p < .05$), indicating that reports of pain intensity increase with increasing age of the child. Sex also had a significant contribution ($\beta = .14$, $p < .05$), with girls reporting higher levels of pain compared to boys. There was no significant contribution of trait anxiety ($\beta = -.01$, ns)[2]. Pain intensity at Time 1 significantly predicted pain intensity six months later at Time 2 ($\beta = .19$, $p < .0001$), with higher levels of pain at Time 1 being associated with higher levels of pain intensity at Time 2. After controlling for the child's pain intensity, the contribution of the child's pain catastrophizing (Time 1) was small but significant ($\beta = .11$, $p < .05$), with higher levels of catastrophizing being associated with higher levels of pain at six months. The interaction between pain intensity and catastrophizing (Time 1) also had a small, but significant contribution ($\beta = -.11$, $p < .05$). To illustrate the pattern reflected in this statistically significant

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[2] Exploration whether the effect of negative affectivity upon pain intensity at follow-up is dependent upon level of catastrophizing (Time 1) revealed no significant interaction effect.

interaction term, we plotted regression lines for high (+1 <u>SD</u> above the mean) and low (-1 <u>SD</u> below the mean) values of the moderator variable (Holmbeck, 2002) (see Figure 1). Significance tests for both slopes showed that the slope for the Low Pain intensity regression line was significant ($\underline{\beta}$ = .20, $\underline{p}$ < .05), indicating higher levels of catastrophizing (Time 1) are associated with higher levels of pain intensity at follow-up (Time 2), but only for children who reported low levels of pain intensity (Time 1). The slope for the High Pain intensity regression line did not reach significance ($\underline{\beta}$ = .02, ns), indicating that higher levels of pain catastrophizing are not associated with higher levels of pain intensity at Time 2 when the Time 1 level of pain was high.

- Insert Table 2 about here -

- Insert Figure 1 about here -

3.5 <u>Value of catastrophizing in predicting functional disability at follow-up and the</u> <u>moderating role of pain intensity</u>

A hierarchical regression analysis was performed to investigate the contribution of the child's catastrophizing (Time 1) in predicting functional disability at six months (see Table 3) and the moderating role of pain intensity (Time 1). The regression analyses with functional disability (Time 2) as dependent variable was similar to the regression analysis with pain intensity (Time 2) as dependent variable, except that we now also controlled for the level of functional disability at Time 1 in the third step of the analysis. Again, variance-inflation factors were acceptable (range 1.06- 1.60), suggesting that there was no problem of multicollinearity.

Analyses revealed a significant effect for age (β = .10, p < .05), indicating that reports of functional disability increase with increasing age of the child. There were no significant

effects for sex (β = .07, ns) and trait anxiety (β = .01, ns)[3]. Baseline level of functional disability (Time 1) had a significant contribution ($\underline{\beta}$ = .26, $\underline{p}$ < .0001), indicating that higher levels of disability (Time 1) are associated with higher levels of disability later (Time 2). Pain intensity at Time 1 had also a significant contribution ($\underline{\beta}$ = .12, $\underline{p}$ <.05), indicating that higher levels of baseline pain are associated with higher levels of functional disability 6 months later. After controlling for the child's initial level of functional disability (Time 1) and pain intensity (Time 1), the contribution of the child's pain catastrophizing (Time 1) was significant (β = .11, p < .05), with higher levels of baseline catastrophizing being associated with higher levels of functional disability at six months. The interaction between pain catastrophizing (Time 1) and pain intensity (Time 1) was small but significant ($\underline{\beta}$ = -.10, p < .05) indicating that the relationship between catastrophizing (Time 1) and functional disability (Time 2) is conditional on initial levels of pain intensity (Time 1). Significance tests for the Low (- 1SD below the mean) and High (+ 1SD above the mean) pain intensity regression line indicated that the slope for the Low Pain intensity regression line was significant ($\underline{\beta}$ = .19, $\underline{p}$ < .05), indicating higher levels of catastrophizing at Time 1 are associated with higher levels of functional disability six months later, but only for children who reported low levels of pain intensity at Time 1. The slope for the High Pain intensity regression line did not reach significance ($\underline{\beta}$ = .03, ns), indicating that higher levels of pain catastrophizing are not associated with higher levels of functional disability at follow-up when the baseline level of pain (Time 1) was high.

- Insert Table 3 about here –

- Insert Figure 2 about here –

3.6 The relationship between trait anxiety and pain catastrophizing

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[3] Exploration whether the effect of negative affectivity upon pain intensity at follow-up is dependent upon level of catastrophizing (Time 1) revealed no significant interaction effect.

Following first, the results of the present study indicating that the effects of pain catastrophizing upon pain and disability at follow-up cannot be accounted for by trait anxiety, and second, the results of previous studies suggesting that a person's anxious disposition might be conceived of as a precursor to catastrophizing (see e.g. Goubert et al., 2004), a hierarchical regression analysis was performed to investigate the contribution of trait anxiety at Time 1 in predicting pain catastrophizing six months later (Time 2) (see Table 4). Similar to previous regression analyses, we also controlled for the child's sex and age in the first step of the analysis. To examine the antecedent status of pain and disability for catastrophizing, pain intensity (Time 1) and functional disability (Time 1) were entered in the second step. In the third step, the child's pain catastrophizing (Time 1) was entered. In the fourth step, the child's level of trait anxiety (Time 1) was entered. Again, variance-inflation factors were acceptable (range 1.05 – 1.56), suggesting that there was no problem of multicollinearity.

Analyses revealed no significant effects for age (β = .06, ns), sex (β = -.01, ns), baseline pain intensity (β = -.01, ns) and functional disability_t0 (β = -.05, ns). As expected, baseline level of catastrophizing (Time 1) had a significant contribution (β =.34, p < .0001), indicating that higher levels of catastrophizing at Time 1 are associated with higher levels of catastrophizing at Time 2. After partialling out the influence of age, sex, pain intensity, functional disability and baseline catastrophizing, trait anxiety, uniquely contributed to the prediction of catastrophizing_t2 (β =.24, p < .0001); higher levels of NA are independently associated with higher levels of catastrophizing 6 months later[4].

<center>- Insert Table 4 about here –</center>

4. DISCUSSION

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[4] Exploration whether the relationship between trait anxiety (Time 1) and pain catastrophizing (Time 2) is moderated by the child's level of pain intensity (Time 1), functional disability_(Time 1) or pain catastrophizing (Time 1) revealed no significant interaction effects.

This study of school attending children was designed to investigate the prospective roles of catastrophic thinking about pain, pain intensity, and trait anxiety and their putative relationship with pain and disability tested six months later. The results were largely as predicted. First, the child's pain catastrophizing at baseline had a unique contribution to the prediction of pain and disability 6 months later, even when controlling for the initial pain and disability levels. Second, moderation analyses revealed that the effects of pain catastrophizing upon pain and disability 6 months later were only true for those children reporting low levels intensity of pain at baseline. ~~In other words, catastrophizing about pain, in particular when pain is mild in intensity, may be a risk factor for later pain and disability.~~ Third, the variability in disability and pain complaint could not be explained by trait anxiety. Instead trait anxiety might be best conceived of as a precursor of catastrophizing in children; i.e. children with higher levels of trait anxiety at baseline were more inclined to report higher levels of catastrophizing at follow-up. These findings do not support the idea that catastrophizing is only an instantiation of trait anxiety (Turner and Aaron, 2001). The effects of both variables are not interchangeable, rather catastrophizing may arise as a function of predispositional factors such as trait anxiety (see also Crombez et al., 2002; Goubert et al., 2004).

Our findings are consistent with previous results demonstrated in cross-sectional studies with children and adults (Sullivan et al., 1995; Crombez et al., 2003; Lynch et al., 2006; Vervoort et al., 2006) and prospective studies with adults (Keefe et al., 1989; Sullivan et al., 1995), and also extend the earlier results in several ways. First, to our knowledge, this is the first study to prospectively investigate the role of pain catastrophizing and trait anxiety in a sample of school children. Second, we focus on the specific conditions under which pain catastrophizing exerts its negative influence. ~~Our results corroborate previous findings from cross-sectional studies that pain catastrophizing is a significant variable in understanding pain and disability outcomes in children (Crombez et al., 2003, Lynch et al., 2006, Vervoort et al.,~~

~~2006).~~ Although explained variance rates were small, the present findings extend previous ones by indicating that higher levels of catastrophizing contribute to deleterious pain and disability outcomes only when their initial pain intensity level was low. ~~Children who reported high levels of pain at baseline were inclined to report high levels of pain and disability 6 months later, regardless their level of catastrophizing.~~

The present findings indicate that characteristics relating primarily to pain (e.g. pain intensity), and specific motivational and cognitive-affective factors (e.g. pain catastrophizing) intersect in predicting pain and disability outcomes. Our results further indicate that catastrophizing might be important in understanding the onset of higher levels of pain but less so for the maintenance of high levels of pain. There are several possible pathways through which pain catastrophizing might affect pain and disability that need further investigation (Edwards et al., 2006).

First, catastrophizing about pain may affect pain intensity and disability through processes related to *vigilance* to threat. In particular, catastrophic thinking about pain has been found to induce a hypervigilance to pain (Van Damme et al., 2004; 2007; Crombez et al., 2005; Van Slyke and Walker, 2006). High catastrophizers may therefore be attentionally biased towards pain or pain-related information. For high catastrophizing children, the experience of pain *in and of itself* may reflect high threat and hence, may be attentionally demanding (Crombez et al., 1998; 1999). Previous findings indicating that threat itself, above and beyond the intensity of pain, is sufficient to interrupt attention (Eccleston and Crombez, 1999), to decrease coping efficacy with pain (Heyneman et al., 1990; Sullivan et al., 1995) and to interfere with daily functioning by inducing avoidance behaviours (Crombez et al., 1999), suggest that appraisal and attentional processes might be invoked to explain how catastrophizing exerts its negative influence upon pain and disability outcomes (Crombez et al., 1998; Sullivan et al., 2001).

Second, catastrophizing may also enhance pain and disability via its effects on the social environment (Buenaver et al., 2007). In particular, it has been suggested that high catastrophizers' appraisals of pain as extremely threatening and difficult to cope with may elicit attempts to seek support from others, for instance by the overt display of pain (Sullivan et al., 2001; 2006). This pathway is not independent from the hypervigilance route expounded above, but perhaps an environmental extension. Heightened threat may not only be attentionally demanding for the individual in pain, but may, through encoding into expressive behaviours, also draw upon other's attention and responsiveness. In support of this view, studies with adults have indicated that higher levels of pain catastrophizing are associated with higher levels of pain expression (Sullivan et al., 2004; 2006), yet may elicit not only solicitous (Giardino et al., 2003), but also critical or punishing responses (Keefe et al., 2003; Cano, 2004). Both types of responses, however, may be mechanisms by which catastrophizing exerts its detrimental effects upon pain outcomes (Buenaver et al., 2007). Solicitous responses may enhance a persons' tendency to avoid pain (Peterson and Palermo, 2004; Van Slyke and Walker, 2006). Punishing responses may add to the aversiveness of pain experiences in ways that similarly enhance avoidance (McCracken, 2005; Buenaver et al., 2007). Few studies, however, have examined pain catastrophizing in children in the context of seeking or demanding help. Preliminary findings are in line with adult literature; higher levels of catastrophizing in children are associated with a more expressive orientation in dealing with pain (Bédard et al., 1997; Vervoort et al., 2008). However, its association with others' responses remains to be investigated.

Of further interest, the children of the present sample showed a rather moderate degree of consistency in their level of catastrophizing over a 6 months period. Although comparisons with other studies are difficult given differences in sample characteristics or time periods, our test-retest correlation coefficient is only half from those that have been reported in other

studies with adults (Keefe et al., 1989; Sullivan et al., 1995). This might indicate that, especially in children, catastrophizing is not a very stable response to pain but might be better considered as modifiable and more situation-specific (Turner and Aaron, 2001; Ellis and D'Eon, 2002). Given that catastrophizing is associated with negative pain related outcomes ánd appears to become more stable in adults than in children, it is important to examine the dynamic properties of catastrophizing throughout child development to come to an understanding of variables that are likely to minimize or promote catastrophizing. As suggested by our findings, children reporting high levels of trait anxiety might be particularly vulnerable to catastrophizing.

There are a number of limitations to this study to be considered. First, the study sample consisted of school children. Further research is needed to examine the generalizability of the results to samples of children with chronic or clinical pain. Second, the measure of disability used in the present study does not evaluate impairment exclusively due to pain. Children were asked to rate perceived difficulty of performing each activity due to 'physical health'. Most likely, this has resulted in an underestimation of the associations between disability, pain catastrophizing and pain. Third, explained variance rates were very small. Other factors, both child-related factors, such as depression (Hoff et al., 2006; Gauntlett-Gilbert and Eccleston, 2007) and parent-related factors, such as parental attention to their child's pain (Chambers et al., 2002) need to be taken into account. Fourth, this study was designed conceptually and specifically to focus on the effects of specific variables. Although the present findings suggest the importance of assessing and targeting catastrophizing, extrapolation to the naturalistic case of clinical pain is premature. Finally, although our findings indicate catastrophizing has an antecedent status for pain and disability outcomes, the present study does not provide a test of whether catastrophizing is a direct cause of pain and

disability. As suggested above, there might be several possible mechanisms underlying or mediating this relationship.

This prospective study is an advance on cross-sectional analyses that dominate the literature. However, this study is prospective in the most minimal form: with a measurement at only two time points. To truly investigate the relational and developmental context of children's pain and pain related behaviour further research is necessary that extends the methodological canon. Prospective studies assessing variables, at least, at 3 consecutive points in time are necessary to make causal inferences about mediation (Cole and Maxwell, 2003). Daily diary studies are possible that allow the assessment of the variability and sensitivity, both within persons and between persons, of anxious behaviour in response to pain. Missing is any understanding of specific pain-related life events and their effects on learning. And finally, some understanding of the role of protective or pain promoting effects of significant others such as parents or peers will be an invaluable part of the picture (e.g. Eccleston et al., 2008).

Acknowledgments

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FIGURE LEGENDS

Figure 1: Regression lines for the relationship between the child's pain catastrophizing at baseline (time 1) and pain intensity at follow-up (time 2) as moderated by baseline pain intensity level of the child (time 1). Standardized Beta's (β) are shown (PCS-C = Pain Catastrophizing Scale for Children).

* p < .05, ** p < .0001

Figure 2: Regression lines for the relationship between the child's baseline catastrophizing (time 1) and functional disability at follow-up (time 2) as moderated by the child's baseline level of pain (time 1). Standardized Beta's (β) are shown (PCS-C = Pain Catastrophizing Scale for Children).

* p < .05

Table 1: Means (M), Standard Deviations (SD), Cronbach's alpha (α) and Pearson intercorrelations of all measures

	M (SD)	α	2	3	4	5	6	7
1. Pain Catastrophizing_t1	12.65 (8.10)	.88	.35***	.44***	.48***	.42***	.13**	.23***
2. Pain Intensity_t1	29.51 (23.32)	---	---	.37***	.28***	.16**	.20***	.22***
3. Functional Disability_t1	6.62 (6.53)	.84		---	.34***	.16**	.17**	.32***
4. Trait anxiety_t1	13.22 (7.36)	.88			---	.37***	.11*	.19***
5. Pain Catastrophizing_t2	11.48 (7.11)	.86				---	.13*	.39***
6. Pain Intensity_t2	23.96 (22.40)	---					---	.35***
7. Functional Disability_t2	5.27 (6.57)	.88						---

$* \ p < .05; ** \ p < .01; *** \ p < .0001$; one-tailed significance test
t1 = baseline measure; t2 = follow-up measure (6 months later)

Table 2: Results of regression analyses predicting *pain intensity_t*2

Standardized regression coefficients (β) from the last step in the analyses are shown

Step	Predictor	β	ΔR^2	Adjusted R^2
1	Age	.11*	.03**	.03
	Gender	.14*		
2	Trait anxiety_t1	-.01	.006	.03
3	Pain intensity_t1	.19**	.04***	.06
	Pain catastrophizing_t1	.11*		
4	Pain intensity_t1 × Pain catastrophizing_t1	-.11*	.01*	.07

*p < .05; ** p < .01 *** p < .001; one-tailed significance test.

Table 3: Results of regression analyses predicting *functional disability_t2*

Standardized regression coefficients (β) from the last step in the analyses are shown

Step	Predictor	β	ΔR^2	Adjusted R^2
1	Age	.10*	.02*	.01
	Gender	.07		
2	Trait anxiety_t1	.01	.03*	.04
	Functional disability_t1	.26***	.08***	
4	Pain intensity_t1	.12*	.02*	.21
	Pain catastrophizing_t1	.11*		
5	Pain intensity_t1 × Pain catastrophizing_t1	-.10*	.01*	.22

*p < .05; ** p < .001; *** p < .0001; one-tailed significance test.

Table 4: Results of regression analyses predicting *Pain catastrophizing_t2*

Standardized regression coefficients (β) from the last step in the analyses are shown

Step	Predictor	β	ΔR^2	Adjusted R^2
1	Age	.06	.01	.01
	Gender	-.01		
2	Pain intensity_t1	-.01	.04**	.04
	Functional disability_t1	-.05		
3	Pain catastrophizing_t1	.34***	.13***	.17
4	Trait anxiety_t1	.24***	.04***	.21

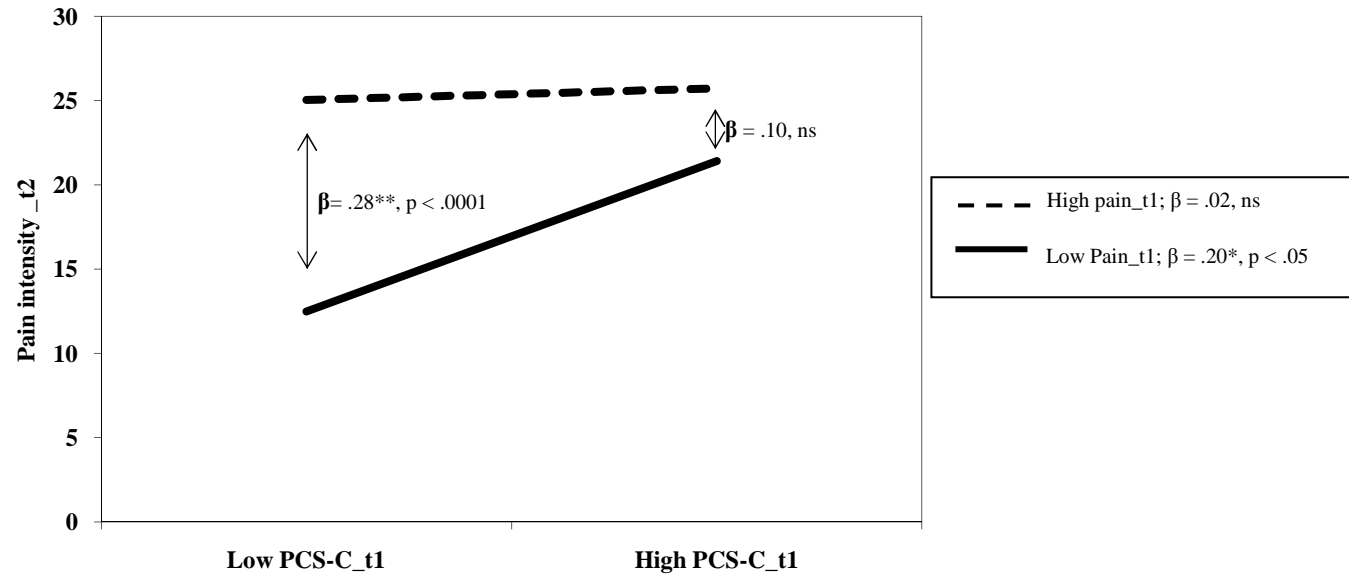** p < .001; *** p < .0001; one-tailed significance test.

Figure 1

Figure 2