

Catastrophic Thinking About Pain is Independently Associated with Pain Severity, Disability, and Somatic Complaints in School Children and Children with Chronic Pain

Tine Vervoort,¹ MSc, Liesbet Goubert,¹ PhD, Christopher Eccleston,² PhD, Patricia Bijttebier,³ PhD, and Geert Crombez,¹ PhD

¹Department of Experimental-Clinical and Health Psychology, Ghent University,

²Pain Management Unit, University of Bath, and ³Department of Psychology, University of Leuven

Objective To investigate the value of pain catastrophizing in explaining pain, disability, and somatic complaints, beyond negative affectivity (NA). **Method** Two cross-sectional studies, one in a sample of school children ($n = 193$) and a second in a clinical sample of children with recurrent or chronic pain ($n = 43$), were conducted. In both studies, measures of pain catastrophizing and NA were examined for their ability to explain pain, disability, and somatic complaints. **Results** In both studies, pain catastrophizing significantly accounted for the variance of pain, disability, and somatic complaints, beyond the effects of age, sex, and NA. Furthermore, pain catastrophizing significantly mediated the relationship between NA and somatic complaints in both studies and between NA and functional disability in study 1. **Conclusions** Results suggest the importance of assessing for pain catastrophizing in children. Pain catastrophizing is further discussed in terms of communicating distress to significant others.

Key words children; functional disability; negative affectivity; pain catastrophizing; pain severity; somatic complaints.

There are many opportunities in childhood to learn that pain is aversive, associated with danger, and largely to be avoided. It is a common experience: children have, on average, an episode of pain every three waking hours (Fearon, McGrath, & Achat, 1996). Children can also experience a diversity of somatic events, including headache, dizziness, and fatigue (Garber, Walker, & Zeman, 1991). Fortunately, when complaints are graded for their severity and impact upon daily living, most episodes appear to be neither severe nor disabling (Garber et al., 1991).

Intrinsic to the experience of pain is its threat value (Eccleston & Crombez, 1999). In the context of pain-as-threat, it has been established that the anticipation and fear of pain can develop (Crombez, Vlaeyen, Heuts,

& Lysens, 1999; Vlaeyen & Linton, 2000). The specific character and frequency of “pain-related fear” have been studied as potentially important processes in explaining pain, disability, and emotional distress (Sullivan et al., 2001b; Vlaeyen & Linton, 2000). Especially important in explaining pain and disability is the extent to which one makes exaggerated and fearful appraisals of pain and its consequences, commonly known as “catastrophic thinking about pain” (Sullivan et al., 2001b).

Complementing the rich seam of theoretical and empirical work that can inform our understanding of childhood pain, the concepts of *fear of pain* and *catastrophic thinking about pain* are ones that have already received a great deal of attention in the adult literature (Sullivan, 2001b; Vlaeyen & Linton, 2000). Considerable

All correspondence concerning this article should be addressed to Tine Vervoort, MSc, Department of Experimental-Clinical and Health Psychology, Ghent University, Henri Dunantlaan 2, B-9000, Ghent, Belgium. E-mail: tine.vervoort@ugent.be.

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research has shown that catastrophizing in adults contributes to more intense pain, disability, and emotional distress (Sullivan, Rodgers, & Kirsh, 2001a). Furthermore, catastrophizing in adults has been associated with the overprediction of pain (Goubert, Crombez, & Van Damme, 2004), greater difficulty disengaging attention from pain (Van Damme, Crombez, & Eccleston, 2002), increased pain behavior, increased use of health care services and medication, and longer hospital stays (Sullivan et al., 2001b).

Although the number of studies of catastrophic thinking about pain in children is small, the results are promising and quite congruent with those of the adult literature. Greater pain catastrophizing in children is related to more pain severity and disability (Crombez et al., 2003), lower pain tolerance (Piira, Taplin, Goodenough, & von Baeyer, 2002), more anxiety and depression (Eccleston, Crombez, Scotford, Clinch, & Connell, 2004), and increased analgesic use (Bédard, Reid, McGrath, & Chambers, 1997).

Some writers have argued that a focus on specific patterns of anxious thinking, such as pain catastrophizing, may underestimate the role of stable individual differences (Watson & Pennebaker, 1989). Previous research findings have revealed that negative affectivity (NA), which can be described as the stable disposition to experience negative and distressing emotions, may underlie the commonly observed associations between specific patterns of anxious thinking and self-reported health complaints, both in adults (Watson & Pennebaker, 1989) and in children (Walker, Garber, Smith, Van Slyke, & Claar, 2001). Watson and Pennebaker (1989) argued that the relationship between NA and somatic complaining is best explained by a hypervigilance in persons with high levels of NA: "First, NAs may be more likely to notice and attend to normal body sensations and minor aches and pains. Second, because their scanning is fraught with anxiety and uncertainty, high NAs may interpret normal symptoms as painful or pathological" (p. 247).

It is therefore likely that people with high levels of NA are more inclined to notice and catastrophize about a diversity of minor aches and pains, but that the effect of NA disappears when somatic sensations become intense and highly salient for everyone (see, Goubert et al., 2004).

To what extent catastrophic thinking about pain is one particular instantiation of the general disposition to experience negative affect, is unclear. Several studies with children suggest that NA may indeed underlie some of the effects of pain catastrophizing: There is an

association between NA and self-report measures of health in children and adolescents (Ondersma, Lumley, Corlis, & Tojek, 1997), and adolescents with chronic pain report more NA than adolescents without chronic pain (Merlijn et al., 2003). Attempts to disentangle the effects of catastrophizing about pain and NA are of both theoretical and clinical interest. NA and pain catastrophizing appear to develop early in life (Sullivan et al., 2001b) and are often maintained throughout the lifespan (Brown, O'Keeffe, Sanders, & Baker, 1986). However, pain catastrophizing is more context-dependent and less stable than personality traits and is therefore more malleable (Sullivan et al., 2001b; Sullivan, Bishop, & Pivik, 1995).

The primary focus of the present article is to disentangle the effects of catastrophic thinking about pain and the effects of NA in accounting for children's somatic complaints, pain severity, and disability. We report two cross-sectional studies of children: one involving a sample of school children and the other involving a clinical sample of children with chronic or recurrent pain. In presenting the results of these studies, we first report correlations between both NA and pain catastrophizing and the three outcome measures. We then consider whether individuals high in NA tend to report less severe somatic complaints. Because conclusions about the health correlates of NA are often based upon outcome measures that combine the number and the severity of complaints, we explored whether NA correlated significantly with individual indexes of the number and/or severity of reported symptoms. Finally, in a series of multiple regression analyses, we investigated the unique role of pain catastrophizing in accounting for somatic complaints, functional disability, and pain severity, beyond the effect of NA. In cases in which the conditions for mediation (see Holmbeck, 2002) were met, we then tested whether pain catastrophizing mediated the relationship between NA and the three outcome measures.

Study 1 Method

Participants

Following approval from the Ghent University Faculty of Psychology and Educational Sciences ethics committee, four Flemish schools in grades 4 through 6 were contacted. All schools agreed to participate. A total of 193 children (89 boys, 104 girls; mean age = 11.1 years, $SD = 0.9$, age range from 9 years to 13.3 years) were recruited. All children in grades 4 through 6 were

approached and agreed to participate in the study. Twenty-three percent of the children ($n = 44$) were recruited from the fourth grade, 25% ($n = 48$) from the fifth grade, and 52% ($n = 101$) from the sixth grade. The final sample for which complete data were available consisted of 174 children: invalid composite scores (more than 25% of the items of a given questionnaire not answered; $n = 19$) were coded as missing values.

Instruments

Somatic complaints were assessed with the Flemish version of the Children's Somatization Inventory (CSI; Bijttebier, Ceuppens, & Keuleers, 2001; Walker & Greene, 1989). The CSI assesses the extent and frequency of 35 somatic complaints (e.g., headaches, constipation, memory loss) that children have experienced during the past two weeks. The children rate each of the items on a 5-point scale (0, "not at all"; 4, "a whole lot"). Total scores can range from 0 to 140. The CSI has shown to be a reliable and valid instrument in previous research (Garber et al., 1991; Meesters, Muris, Ghys, Reumerman, & Rooijmans, 2003).

Pain-related disability was assessed with the Dutch version of the Functional Disability Inventory (FDI; Crombez et al. 2003; Walker & Greene, 1991). The FDI is a self-report inventory for children that measures perceived difficulty in performing a number of activities in the domains of school, home, recreation, and social interactions. It consists of 15 items to be rated on a 5-point scale (0–4) and yields total scores that can range from 0 to 60. The reliability and validity of the FDI has been demonstrated in research by Walker and Greene (1989).

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 are 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, magnification, and helplessness. The PCS-C has shown to be a reliable and valid instrument in children from 9 to 15 years (see Crombez et al., 2003).

Pain severity was assessed by two Visual Analogue Scales (VAS). Children rated their "most severe pain" in the past three weeks and their "present pain severity" on a 10 cm VAS with the end points "no pain" and "a lot of pain." The pain severity VAS has a good reliability and

validity in children 9–15 years old (McGrath, 1987). As the various forms of the VAS are usually correlated (Johnston, 1998), we calculated the mean score of "present pain intensity" and "most severe pain" as an index of pain severity.

NA was assessed using the emotional instability subscale of the Hierarchical Personality Inventory for Children (HiPIC; Mervielde & De Fruyt, 1997, 1999). The HiPIC is a 144-item questionnaire measuring five broad personality factors (extraversion, conscientiousness, emotional instability, imagination, and benevolence-agreeableness) in children from 6 to 12 years. The emotional instability scale contains 2 subscales, self-confidence (reversed scored) and anxiety/depression, and consists of 16 items. Participants rate the degree to which each item is characteristic for them on a 5-point scale (1, "not at all"; 5, "very much"). Total scores can range from 16 to 80 with higher scores indicating higher emotional instability.

To avoid ambiguity, the label *negative affectivity* will be used instead of emotional instability when referring to this measure. This relabeling is justified. First, the content of the HiPIC items closely resembles with those of other NA measures. Second, studies investigating the construct validity of the HiPIC, have revealed that both the emotional instability scales of the HiPIC and the N(euroticism)-facets of the NEO Personality Inventory – Revised (NEO PI–R) load highly on the same factor in adolescents. (Costa, & McCrae, 1992; De Fruyt, Mervielde, Hoekstra, & Rolland, 2000). The HiPIC has been shown to have good reliability and validity (De Fruyt et al., 2000).

Procedure

Four schools were contacted by two research assistants. All four schools agreed to take part in the study. Teachers and parents received a letter in which the purpose of the study was explained. Written informed parental consent and child assent were obtained. The set of questionnaires described above was administered to the children during their regular school hours.

Results

Descriptive Statistics

Overall, the frequency of somatic complaints on the CSI was low ($M = 16.13$, $SD = 14.37$), comparable with findings of Meesters et al. (2003) in a community sample of adolescents. The five most frequent symptoms (items endorsed "a lot" or "a whole lot") were headaches (19.2%), stomach pain (11.9%), pain in limbs (9.8%), sore muscles (9.3%), and nausea/upset stomach (7.8%). 54.9% of the children reported at least one severe physical symptom.

Children reported low to moderate levels of pain severity on the VAS. The mean ratings were 20.16 ($SD = 24.78$) for the present pain level and 48.82 ($SD = 27.88$) for the highest pain level. 90.6% of the children reported at least one pain experience in the past 3 weeks. However, 82.4% of them reported that the pain was very little to moderate. Only 3.8% of the children reported constant pain. These findings are in line with ones obtained previously (Perquin et al., 2000) and indicate that pain is a common experience and complaint in childhood and adolescence.

There were low levels of functional disability in this sample ($M = 8.18$, $SD = 7.82$), compared to findings in clinical pediatric pain patients (Crombez et al., 2003; Kashikar-Zuck, Goldschneider, Powers, Vaught, & Hershey, 2001). The mean level of catastrophic thinking about pain ($M = 13.27$, $SD = 8.72$) was similar to those of Crombez et al. (2003). The mean NA was 42.55 ($SD = 9.37$), similar to the normative mean scores for children aged 6–12 years (Mervielde & De Fruyt, 1997).

Correlations

Mean scores, standard deviations, Cronbach's α coefficients, and Pearson intercorrelations for pain catastrophizing, pain severity, somatic symptoms, functional disability, and NA are summarized in Table I. As expected, the positive correlation between pain catastrophizing and NA was significant. Statistically significant positive associations were also found for pain catastrophizing with pain severity, somatic complaints, and pain-related disability. By comparison, NA was significantly and positively related to somatic complaints and functional disability, but not with pain severity.

Further analyses were performed to examine whether NA correlated with the number and/or mean severity ratings of symptoms/disability reported. Separate indexes were computed for the number of somatic complaints and functional disabilities reported (i.e., the number of symptoms/disabilities that children reported as having been

present) and for the mean severity ratings (i.e., the total score on the CSI and FDI divided by the number of somatic complaints, respectively functional disability reported). The correlation analyses revealed that NA was significantly correlated with the number of somatic symptoms reported ($r = .24$, $p < .001$), but not with the mean severity ratings of somatic symptoms ($r = .10$, ns). Similarly, NA was correlated significantly with the number of functional disabilities ($r = .22$, $p < .01$), but not with the mean severity of the disability ratings ($r = -.07$, ns).

The Predictive Value of NA and Pain Catastrophizing

Next, three hierarchical regression analyses were conducted to examine the contribution of NA and pain catastrophizing in explaining somatic complaints, pain severity, and disability. In each analysis, sex (boys coded as 0, girls coded as 1) and age were entered in step 1 to control for the possible effects of these sociodemographic variables. NA was entered in step 2, and pain catastrophizing was entered in step 3. The results of these analyses are reported in Table II.

The regression analysis with *somatic complaints* as the dependent variable revealed that NA, $F_{\text{change}}(1, 169) = 7.10$, $p < .01$, $\Delta R^2 = .04$, and pain catastrophizing, $F_{\text{change}}(1, 168) = 116.00$, $p < .0001$, $\Delta R^2 = .38$, were both significant predictors. The analysis with *pain severity* as the dependent variable revealed that NA was not a significant predictor, $F_{\text{change}}(1, 169) = 1.62$, $\Delta R^2 = .01$, ns . Pain catastrophizing, however, had a unique contribution in explaining pain severity, beyond age, sex, and NA, $F_{\text{change}}(1, 168) = 26.13$, $p < .0001$, $\Delta R^2 = .13$. Finally, a regression analysis with *functional disability* as the dependent variable was performed. Both NA, $F_{\text{change}}(1, 169) = 5.38$, $\Delta R^2 = .03$, $p < .05$, and pain catastrophizing, $F_{\text{change}}(1, 168) = 52.64$, $p < .0001$, $\Delta R^2 = .23$, emerged as significant predictors in this analysis.

The variance-inflation factors (VIF) of all three regression analyses were acceptable (range 1.05–1.20), suggesting that there was no problem of multicollinearity.

Table I. Means (M), Standard Deviations (SD), Cronbach's α , and Pearson Intercorrelations of Pain Catastrophizing, Pain Severity, Somatic Complaints, Functional Disability, and Negative Affectivity in a Sample of School Children Study 1, Correlation Coefficients Above the Diagonal) and in a Clinical Sample Study 2 Correlation Coefficients Below the Diagonal)

	Study 1		Study 2		1	2	3	4	5
	M (SD)	α	M (SD)	α					
1. Pain catastrophizing	13.27 (8.72)	.89	21.88 (11.44)	.90	—	.38***	.66***	.49***	.36***
2. Pain severity	34.49 (22.57)	.63	65.43 (21.39)	.52	.49**	—	.52***	.33***	.11
3. Somatic complaints	16.13 (14.37)	.90	26.35 (16.73)	.88	.55**	.45**	—	.64***	.21*
4. Functional disability	8.18 (7.82)	.86	21.21 (11.30)	.88	.50**	.57***	.44**	—	.16*
5. Negative affectivity ¹	42.55 (9.37)	.61	33.99 (7.86)	.88	.57***	-.04	.35**	.24	—

* $p < .05$. ** $p < .01$. *** $p < .001$.

¹HiPIC emotional instability scale p2 study 1; STAiC-T p2 study 2.

Table II. Prediction of Somatic Complaints, Pain Severity, and Disability in a Sample of School Children (Study 1) and in a Clinical Sample (Study 2) : Results of Hierarchical Regression Analyses

Criterion variable	Step	Predictor	Study 1			Study 2		
			β	ΔR^2	Adjusted R^2	β	ΔR^2	Adjusted R^2
Somatic complaints	1	Age	-.12	.04	.03	.01	.02	-.03
		Sex	-.13*			.04		
	2	Negative affectivity ^a	.02	.04*	.06	.04	.12*	.07
Pain severity	1	Age	-.11	.02	.01	.14	.08	.03
		Sex	-.09			.05		
	2	Negative affectivity ^a	-.01	.01	.02	-.44*	.00	.00
Functional disability	1	Age	-.01	-.00	-.01	.40**	.27**	.23
		Sex	-.17*			.18		
	2	Negative affectivity ^a	.04	.03*	.02	.02	.06	.26
	3	Pain catastrophizing	.40***	.13***	.14	.68***	.30***	.31
Functional disability	1	Age	-.01	-.00	-.01	.40**	.27**	.23
		Sex	-.17*			.18		
	2	Negative affectivity ^a	.04	.03*	.02	.02	.06	.26
	3	Pain catastrophizing	.53***	.23***	.25	.40*	.11*	.36

Standardized betas of the last step in the analysis are displayed.

^aHierarchical Personality Inventory for Children, emotional instability scale for sample of school children; STAIC-T for clinical sample.

* $p < .05$. ** $p < .01$. *** $p < .0001$

The contribution of the three individual subscales of the PCS-C could not be examined, however, as the VIF > 2 did present problems for this regression analysis.

Mediation Analyses

To test for mediation, the following conditions should be met; (a) a significant association between the predictor and the outcome variable (path a in Figs 1 and 2), (b) a significant association between the predictor and the mediator (path b in Figs 1 and 2), and (c) a significant association between the mediator and the outcome variable, after controlling for the effect of the predictor (path c in Figs 1 and 2). If all of these conditions are met, one then examines whether the impact of the predictor on the outcome is significantly reduced after controlling for the putative mediating variable. (Holmbeck, 2002). Sobel's significance test was used to determine whether the predictor → outcome effect is significantly reduced upon introduction of the

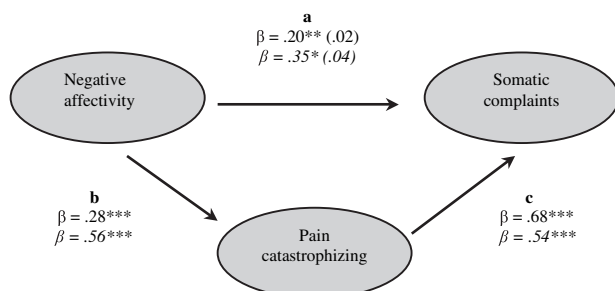


Figure 1. Pain catastrophizing mediates the relationship between NA and somatic symptoms in a sample of school children and in a clinical sample (printed in italics). Standardized betas are shown. The standardized beta within parentheses refers to the direct effect of NA on the outcome measures when controlling for catastrophizing. * $p < .05$; ** $p < .01$; *** $p < .0001$.

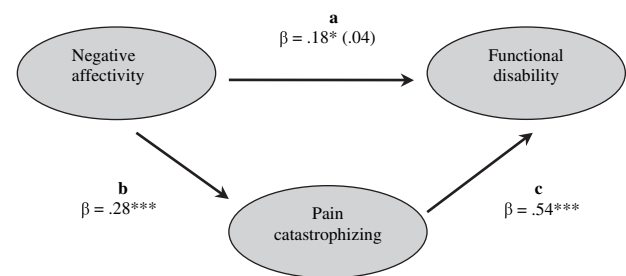


Figure 2. Pain catastrophizing mediates the relationship between NA and functional disability in a sample of school children. Standardized betas are shown. The standardized beta within parentheses refers to the direct effect of NA on functional disability when controlling for catastrophizing. * $p < .05$; *** $p < .0001$.

putative mediator. The percentage of the total effect that was mediated was also computed. The conditions for conducting a mediation analysis were met for the outcome measures of somatic complaints and functional disability, but not for the measure of pain severity.

First, we investigated whether pain catastrophizing mediated the relationship between NA and somatic complaints. The tested model is illustrated in Fig. 1. Mediation analyses revealed a Sobel z -score = 3.65, $p < .0005$, indicating significant mediation. Pain catastrophizing accounted for 92.57% of the relationship between NA and somatic complaints.

In a second mediation analysis, we investigated whether pain catastrophizing mediated the relationship between NA and functional disability. The tested model is illustrated in Fig. 2. Mediation analyses revealed a Sobel z -score = 3.45, $p < .0005$, indicating significant mediation. Pain catastrophizing accounted for 82.39% of the relationship between NA and functional disability.

Discussion

In a large sample of school children, we found that the experience of somatic symptoms, pain, and its impact upon daily functioning are in line with the results of previous studies (see, Meesters et al., 2003; Perquin et al., 2000). The results reveal that pain is a common somatic experience in children. In fact, the most frequently occurring somatic complaints were pain complaints: headache, stomach pain, pain in joints, followed by sore muscles, and nausea/upset stomach. We also found that catastrophizing about pain was positively related to somatic complaints, pain severity, and functional disability and that the stable disposition to experience negative affect was related to somatic complaints, functional disability, and pain catastrophizing. However, further analyses indicated that children scoring high on NA tend to report a greater diversity of somatic complaints and functional disability, but not necessarily a greater severity.

Of interest in this study was the specific role of pain catastrophizing and NA in predicting somatic complaints, pain severity, and disability. Despite the fact that pain catastrophizing and NA were significantly associated, the predictive value of pain catastrophizing cannot be accounted for in terms of its overlap with the effect of NA. Pain catastrophizing had a unique and important role in explaining somatic complaints, pain severity, and disability beyond NA. Moreover, pain catastrophizing mediated the relationship between NA and both somatic complaints and functional disability.

The main objective of study 2 was to explore further the role of pain catastrophizing and NA. As the results of study 1 may not generalize to samples other than school children, we decided to use a clinical sample of children with chronic or recurrent pain.

Study 2

Method

Participants

The participants in study 2 were drawn from the clinical sample of Crombez et al. (2003). The results of study 2 are secondary analyses of these data. Forty-three children with recurrent or chronic pain (23 girls, 20 boys; mean age = 11.8 years, $SD = 2.14$; range 8.25–16.5 years) were recruited from a pediatric ward setting in the University Hospital of Leuven on a consecutive basis. Approval was obtained in accordance with institution review board requirements. Participants were hospitalized at the pediatric ward. As part of a standard assessment procedure for pediatric patients, they were referred

to the child psychiatric unit for psychological evaluation of their pain complaints.

The mean duration of the pain complaints was 34.98 months ($SD = 35.31$, range 2–120). The most frequent pain complaints were abdominal pain ($n = 18$, 41.9%) and headaches ($n = 14$, 32.6%). Less frequent pain complaints were joint pain ($n = 4$, 9.3%), low back pain ($n = 3$, 7.0%), pain in the legs ($n = 2$, 4.7%) and pain in the hip ($n = 2$, 4.7%). The mean level of global functioning, as assessed by the DSM-IV Axis V rating by a psychiatrist, was 57.46 ($SD = 12.27$) at the time of the study and 72.88 ($SD = 13.09$) for the past year. The mean number of past hospitalizations was 4.21 ($SD = 3.96$), the mean number of outpatient visits was 15.40 ($SD = 15.04$). All participants who were approached agreed to participate in the study.

The final sample for which complete data were available consisted of 38 children: invalid composite scores (more than 25% of the items of a given questionnaire not answered; $n = 5$) were coded as missing values.

Instruments

Somatic complaints, functional disability, and pain catastrophizing were assessed by the CSI, the FDI, and the PCS-C, respectively. A description of these instruments can be found in the method section of study 1.

Pain severity was assessed on a 0- to 10-cm Visual Analogue Scale (VAS; 0, “no pain”; 10, “a lot of pain.”) The participants were asked to rate their “average” and “highest” pain severity in the past 2 weeks. As in study 1, the mean score of “average pain intensity” and “highest pain intensity” was calculated as an index of pain severity.

Negative affectivity was assessed by the Trait version of the Dutch version State-Trait Anxiety Inventory for Children (STAIC-trait; Bakker, Van Wieringen, Van der Ploeg, & Spielberger, 1989; Spielberger, Edwards, Lushene, Montuori, & Platzek, 1973). Measures of trait anxiety are highly correlated with measures of NA and are often used as measure of NA because of their brevity (Watson & Clark, 1984). To avoid confusion, we will use the term *negative affectivity* instead of trait anxiety.

The STAIC-trait is a 20-item questionnaire designed to measure the anxious disposition in children to interpret situations in a threatening way. 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 (see Bakker et al., 1989; Spielberger et al., 1973).

Procedure

All children, adolescents, and their parents were informed about the research purpose of the study. Informed consent was obtained from all 43 children and their parents. All questionnaires were administered by clinical child psychology trainees.

Results

Descriptive Statistics

As expected, the participants in this clinical sample reported high levels of somatic complaints ($M = 26.35$, $SD = 16.73$), comparable with findings of Walker and Greene in a sample children with recurrent abdominal pain (1989). The five most frequently reported severe somatic complaints (i.e., items endorsed “a lot” or “a whole lot”) were stomach pain (48.8%), headaches (39.6%), low energy (32.6%), nausea/upset stomach (27.9%), and dizziness (25.6%). At least one severe physical symptom was reported by 90.7% of the sample.

Participants reported high levels of pain on the VAS. The mean ratings were 82.98 ($SD = 20.53$) for the highest pain level and 47.88 ($SD = 30.58$) for the average pain level. There were high levels of disability ($M = 21.21$, $SD = 11.30$), comparable with previous findings in clinical pediatric pain patients (Kashikar-Zuck et al., 2001). The mean level of pain catastrophizing ($M = 21.88$, $SD = 11.44$) was higher than the mean score reported in a sample of nonclinical pediatric pain patients (Crombez et al., 2003).

Correlations

Mean scores, standard deviations, Cronbach α , and Pearson intercorrelations for pain catastrophizing, mean pain severity, somatic complaints, functional disability, and NA are presented in Table I. There was a significant correlation between pain catastrophizing and NA. Furthermore, pain catastrophizing correlated significantly with somatic complaints, pain severity, and disability. NA was significantly correlated with somatic complaints, but not with pain severity and disability.

Additional analyses were conducted to examine whether NA correlated significantly with both the number and mean severity ratings of the somatic complaints reported (see, *study 1*). Correlation analysis revealed that NA was significantly correlated with the number of somatic symptoms reported ($r = .36$, $p < .05$), but not with the mean severity ratings of somatic symptoms ($r = .14$, *ns*). The correlation of NA with both number and severity of disability was not examined as NA did not correlate significantly with disability.

The Predictive Value of NA and Pain Catastrophizing

Similar regression analyses were performed as in study 1. The results of these analyses are reported in Table II. The regression analysis with *somatic complaints* as the dependent variable revealed that both pain catastrophizing, $F_{\text{change}}(1, 35) = 9.68$, $p < .01$, $\Delta R^2 = .19$, and NA, $F_{\text{change}}(1, 36) = 4.97$, $p < .05$, $\Delta R^2 = .12$, were significant predictors. The analysis with *pain severity* as the dependent variable revealed that only pain catastrophizing was a significant predictor, $F_{\text{change}}(1, 35) = 16.84$, $p < .0001$, $\Delta R^2 = .30$. NA was not a significant predictor of pain severity, $F_{\text{change}}(1, 36) = .11$, $\Delta R^2 < .01$, *ns*. Finally, the regression analysis with *functional disability* as the dependent variable was performed. Again, pain catastrophizing contributed uniquely to the prediction of disability, $F_{\text{change}}(1, 34) = 6.38$, $p < .05$, $\Delta R^2 = .11$. NA was not a significant predictor, $F_{\text{change}}(1, 35) = 2.85$, $\Delta R^2 = .06$, *ns*.

The VIF of all regression analyses were acceptable (range 1.00–1.57), indicating that there was no problem of multicollinearity. As in study 1, the contribution of the three subscales of the PCS-C could not be examined, as $VIF > 2$ presented problems for the regression analysis. Because of the small sample size, post hoc power analysis for multiple regression was calculated using G*Power version 2.0 (Faul & Erdfelder, 1992). Results revealed adequate power for all regression analysis (.89, .98, and .95, respectively, for the regression analyses with functional disability, somatic complaints, and pain intensity as dependent variable).

Mediation Analyses

Conditions to test for mediation were met for the outcome measure of somatic complaints, but not for the measures of functional disability and pain severity. We investigated whether pain catastrophizing mediated the relationship between NA and somatic complaints. The tested model is illustrated in Fig. 1. Mediation analyses revealed a Sobel z -score = 1.94, $p = .05$, indicating significant mediation. Pain catastrophizing accounted for 85.06% of the relationship between NA and somatic complaints.

Discussion

In comparison with study 1, the experience of somatic complaints is more severe and aversive in our sample of pediatric patients. The children reported a wide diversity of somatic complaints, including a high frequency of non-painful sensations such as nausea, upset stomach, low energy and dizziness. Furthermore, the children reported severe pain and a strong interference with daily functioning.

Despite these differences, the pattern of results was very similar to that of study 1. Pain catastrophizing was positively related to somatic complaints, pain severity, and disability. In contrast, NA was only related to pain catastrophizing and somatic complaints. As in study 1, children scoring high on NA tend to report a greater diversity of somatic complaints, but not a greater severity. Furthermore, pain catastrophizing, but not the stable disposition to experience negative affect, proved to have an important and unique role in predicting somatic complaints, pain severity, and disability. Moreover, pain catastrophizing significantly mediated the relationship between NA and somatic complaints. It is clear that in our clinical sample of children, the effect of pain catastrophizing can also not be accounted for in terms of its overlap with the effect of NA.

General Discussion

Two studies, one in a more general sample of school children (study 1) and the second in a clinical sample of children with recurrent or chronic pain (study 2), were conducted to examine the role of pain catastrophizing and NA in explaining somatic complaints, pain severity, and disability. The results may be readily summarized. First, the unique value of NA in explaining somatic complaints, pain severity, and disability was small or nonexistent in both studies. Second, the role of pain catastrophizing in explaining somatic complaints, pain severity, and disability was substantial in both studies, even when controlling for the effects of NA. Third, pain catastrophizing mediated the relationship between NA and somatic complaints in studies 1 and 2 and between NA and disability in study 1. Fourth, in studies 1 and 2 NA had a pronounced effect upon the number of somatic complaints, but not upon their severity. In study 1, NA had a similar effect upon disability.

The results of both studies clearly add to the small but growing literature on the central role of pain relevant thinking in both normal and chronic childhood pain (Crombez et al., 2003; Piira et al., 2002). The variability in disability and pain complaint cannot be explained by any underlying stable personality variables such as NA, but it is a function of more specific cognitive-emotional factors such as pain catastrophizing. Our findings further suggest that children with high levels of NA are inclined to report a wide diversity of somatic complaints, and functional limitations, but this does not imply that these complaints and limitations are severe.

These findings are in line with adult research showing that NA is related to subjective health measures, but

only weakly or inconsistently when disability or severity are taken into account (Ondersma et al., 1997; Watson & Pennebaker, 1989). There are at least two explanations for these findings. First, high NA individuals may be more likely to notice and attend to normal body sensations and minor discomforts than low NA individuals (Watson & Pennebaker, 1989). However, these effects of NA may only be present when somatic complaints are not salient and less intense. Second, high NA individuals may have a general bias to report and to complain about negative events, including minor ones.

Recent progress has been made in extending theories of catastrophizing about pain to a communal context (Sullivan et al., 2001b). Sullivan, Adams, & Sullivan (2004) have argued that catastrophic thinking about pain could usefully be considered, not simply as a private intrapsychic event, but as a social communication of distress. From this point of view, what is important about catastrophizing is the proximity of helpful others and the likelihood that they will react emphatically (Crombez & Eccleston, 2002).

The development of a communal model of pain catastrophizing fits very neatly into a systemic understanding of child development and childhood coping with adversity (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001). But if this communal model is to be useful with children, a developmental perspective will be needed (Walco, 2004). For some children, and for most children at some developmental periods, "excessive" fear is normal and usually diminishes with age (Gullone, King, & Ollendick, 2001). When a child catastrophizes about pain, the immediate responses of those proximal to the child in providing succour, and the pain behaviors other people model, are likely to be formative of the child's future responses to pain. At present, there is no theory of threat-related thinking in childhood chronic pain that is formed from a developmental perspective. Such theory is needed to account for how the processes of anticipating and avoiding pain segue into the processes that impair coping, worsen suffering, and potentially retard social development.

A number of methodological issues in these studies should be noted. First, although we have shown associations between key variables in two samples, the studies are cross-sectional. We are not able to infer any causal relationships. Second, although we used a reliable and valid measure of somatic complaints, 23% of the items on this measure refer to pain. It is possible that the pain-related item content inflated the effects of pain catastrophizing on somatic complaints. Third, children in the clinical sample of study 2 presented with various

chronic pain problems. Although our results suggest that catastrophic thinking about pain is a key variable in explaining pain, disability, and somatic complaints for a range of chronic pain problems, studies investigating catastrophic thinking about pain in more homogeneous groups is warranted.

Fourth, some of the differences between study 1 and study 2 may be due to the use of two measures of NA. However, the results of both studies were largely consistent, attesting to the robustness of our findings. Fifth and finally, it should be remembered that there are very few empirical studies of threat-related processes in childhood chronic pain. Replication of these findings with larger samples and from other settings is necessary.

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