

## **Mothers' and fathers' responses to their child's pain moderate the relationship between the child's pain catastrophizing and disability**

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## **ABSTRACT**

Preliminary evidence suggests that pain catastrophizing in children may be important in understanding how parents respond to their child's pain. However, no study has investigated whether parental responses, in turn, moderate the impact of child's catastrophizing upon pain outcomes. The present study was designed to address this and investigated the association of the child's catastrophizing with different types of parental responses (i.e. solicitousness, discouragement and coping promoting responses) and the extent to which parental responses moderate the association between the child's catastrophizing and disability. Participants were 386 school children and their parents. Analyses revealed significant associations between the child's pain catastrophizing and parental responses, but with mothers and fathers evidencing different patterns; i.e. higher levels of the child's catastrophizing were significantly associated with lower levels of solicitousness by fathers, and with higher levels of discouragement by mothers. Moderation analyses indicated that father's solicitousness moderated the association between catastrophizing and disability; the positive association between catastrophizing and the child's disability was further strengthened when fathers reported low levels of solicitousness, but became less pronounced when fathers reported high levels of solicitousness. Findings also revealed a moderating impact of mothers' and fathers' promotion of their child's well behaviour/coping. Specifically, the detrimental impact of child catastrophizing upon disability was less pronounced when parents reported *high* promotion of their child's well behaviours/coping. The findings of the present study suggest the importance of assessing and targeting parental responses to their child's pain to alter the adverse impact of the child's pain catastrophizing upon pain outcomes.

## INTRODUCTION

Pain is a common experience in children [23;35] that may significantly interfere with the child's daily functioning [32]. Various individual characteristics have been identified that may serve as vulnerability factors for the child's adjustment to pain. In particular, pain catastrophizing, defined by the child's negative and exaggerated appraisals of pain, has emerged as a salient determinant of deleterious outcomes such as increased disability [42; 45; 48]. In addition, there is a growing body of research indicating that not only individual child characteristics, but also parental behaviours may influence the child's adaptation to pain [19; 33]. For example, parental solicitousness (e.g., granting special privileges to the child) and parental discouragement (e.g., criticizing the child) have both been found to be associated with increased disability [9; 36].

However, findings have indicated that parental responses are likely to interact with the effects of individual child characteristics upon child pain outcomes. Indeed, evidence suggests that children differ in their vulnerability to adverse outcomes in the presence of maladaptive parental responses [see e.g. 9; 36; 51; 52]. This may be particularly important when considering child catastrophizing about pain. Child catastrophizing has been found to be associated with increased pain expression and social support seeking [44, 46], which, in turn, appears to elicit both solicitous and discouraging responses from others [19; 47]. Accordingly, children who highly catastrophize about pain may not only be highly dependent upon the care available through others [42], they may also be most likely to elicit the type of responses that may further strengthen the adverse impact of catastrophizing. To date, preliminary evidence supporting this hypothesis stems from studies in adults [5; 18], but remains to be investigated in children.

In addition, there are other gaps in the literature that need to be addressed. First, studies investigating parental responses to the child's pain have mainly focused upon

solicitousness and discouragement [36; 51]. Investigating other types of parental responses, such as parental encouragement of coping behaviour (e.g., encourage the child to use distraction) [19; 24], is equally important as this may shed light on responses that may eventually protect the child from otherwise more negative outcomes [12;22]. Second, studies on paediatric pain have largely overlooked the role of fathers [37]. However, fathers play an important and unique role in their child's development [15; 27]. Furthermore, recent evidence has highlighted the importance of taking into account both mothers and fathers in further delineating the role of parents in understanding the child's pain experience [29; 43].

The present study addressed the following hypotheses; (1) higher levels of child catastrophizing are expected to be associated with increased solicitousness and discouragement, and (2) both types of parental responses are expected to strengthen the adverse impact of catastrophizing upon disability. Further, the present study also (3) explored the role of parental coping promoting responses and (4) assessed whether mothers' and fathers' responses differentially relate to the child's pain catastrophizing and play a differential moderating role in the association between child catastrophizing and disability.

## **METHOD**

### Participants

Eighteen Flemish schools in grades 4 through 12 were contacted. Nine schools agreed to participate. The main reason to refuse participation was involvement in other research projects. A total of 2681 parents and children were invited to participate. Of these, 199 refused participation and 1395 did not respond. Of the 1087 children who agreed to participate, 927 effectively did. Illness was the most common reason for drop out. Of these 927 children, 525 mothers and 462 fathers also agreed to participate. Because the present study aimed at exploring differences between mothers and fathers, we only included the data of children of whom both the mother and father had completed questionnaires (i.e., 428 children). Missing

values analyses further indicated that complete data were available for 386 children (206 girls and 180 boys) and both of their parents: invalid composite scores (i.e., more than 25% of the items of a given questionnaire not answered) were coded as missing values. No data are available for non-responders, except for the child's grade level which indicated somewhat lower response rates from children from grades 11 and 12 as compared to lower grades. There were no differences on the child demographic variables and questionnaire measures between children from whom both parents had provided data and children from whom only one parent had responded. The mean age of the children was 12.77 years (SD = 2.19, range 8 years to 18 years). Approximately 6% of the children (n = 22) were recruited from the fourth grade, 7.8% (n = 30) from the fifth grade, 10.4% (n = 40) from the sixth grade, 18.7% (n = 72) from the seventh grade, 23.3% (n = 90) from the eighth grade, 13.7% (n = 53) from the ninth grade, 10.6% (n = 41) from the tenth grade, 6% (n = 23) from the eleventh grade, 3.6% (n = 14) from the twelfth grade. The mean age of the mothers was 43.19 years (SD = 4.62; range = 27 to 58 years) and for the fathers 45.19 years (SD = 5.06; range = 32 to 61 years). The majority (308; 79.8%) of the parents was married or co-habiting. Approximately 70% of the parents had a higher education (beyond the age of 18 years).

## Measures

### *Child report measures*

Catastrophic thinking about pain was assessed with the Dutch version of the *Pain Catastrophizing Scale for Children (PCS-C)* [13]. This instrument is an adaptation of the adult Pain Catastrophizing Scale [40]. 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 demonstrated good construct, internal and predictive validity in children aged 9 to 15 years [13]. In the present study, the Cronbach's  $\alpha$  was .88.

Pain severity was assessed by means of a *Visual Analogue Scale (VAS)*. Children rated their 'most severe pain' in the past two weeks on a 100 mm VAS with the end points 'no pain' and 'a lot of pain'. The pain severity VAS has a good reliability and validity [49].

Pain-related disability was assessed with the Dutch version of the *Functional Disability Inventory (FDI)* [50]. The FDI is a self-report inventory for children that measures the child's perceived difficulty in performing a number of activities in the domains of school, home, recreation, and social interactions during the past two weeks. 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 construct, concurrent and predictive validity of the English FDI has been demonstrated [11; 50]. The reliability of the Dutch version has been demonstrated in various studies indicating high internal consistency [e.g. 13; 45; 48]. In the present study, the Cronbach's  $\alpha$  was also high (.88).

#### *Parent report measures*

Parental responses to their child's pain were assessed with the Dutch version of the *Inventory of Parent/Caregiver Responses to Children's Pain Experience (IRPEDNA)* [24]. The IRPEDNA was chosen because this measure was specifically designed to be used not only in parents and caregivers of children with chronic pain, but also in parents and caregivers of healthy children experiencing everyday pain. Items from the IRPEDNA were derived from (1) existing questionnaires with similar objectives and comparable content (e.g. [53]) and (2) semi-structured interviews with mothers and fathers of schoolchildren. The IRPEDNA has shown appropriate psychometric properties when administered to parents of schoolchildren [24]. For the present study, the IRPEDNA was translated into Dutch using the forward-backward translation method. The IRPEDNA originates from an operant conceptualization of

pain behaviour [16] and consists of three interrelated subscales; ‘solicitousness’ (15 items reflecting parental positive and negative reinforcement of the child’s pain (e.g., ‘spend as much time with child as possible’ or ‘take over child duties and responsibilities’), ‘discouragement’ (10 items reflecting parental ignorance/discounting of the child’s pain and criticizing the child’s pain as excessive ( e.g., ‘not listen to the child’ or ‘get angry and tell child not to complain so much’) and ‘promotion of well-behaviours and coping’ (12 items reflecting parental promotion of children’s adaptive behaviours (e.g. ‘advise the child to relax and breathe deeply’ or ‘use humor to take her/his mind of the discomfort’). Using a five-point scale (0 = ‘never’ to 4 = ‘always’), parents rated how often they enacted each of the reactions described in each item. Mean item scores were calculated for each subscale yielding total scores ranging from 0-4 for each subscale. The IRPEDNA has shown to be a reliable and valid instrument in a sample of parents of school children and adolescents [24]. In the present study, all subscales revealed high internal consistency (Cronbach’s alpha ranging from .80 to .89).

### Procedure

Schools were contacted by research assistants, first by letter, then by phone. After consent was obtained from the school principal, parents received a letter in which the purpose of the study was explained. Both parents and children were invited to participate. Written informed parental consent for the child’s participation, and child assent, was obtained. Questionnaires were administered to the children during regular school hours. Questionnaires for mothers and fathers and informed consents for the parents’ participation were sent home with the child and were returned by mail. This study was approved by the ethical committee of the Faculty of Psychology and Educational Sciences of Ghent University.

## **RESULTS**

### Descriptive statistics

Mean scores, standard deviations, and correlation coefficients for all measures are presented in Table 1. Children's self-reported pain characteristics are similar to other findings reported in previous research in samples of schoolchildren [e.g., 13, 23, 45]. Briefly, pain complaints seem to be quite common amongst schoolchildren. Specifically, the majority of the children (88.1%) reported at least one painful experience in the past two weeks. Of these children, 22.3% reported having experienced pain 'only once', 49.4% 'sometimes', 13.5% 'often' and 2.9% reported experiencing 'constant' pain. In comparison with previous findings, the children reported moderate levels of pain intensity and catastrophizing [13] and low levels of functional disability [23].

In general, both mothers and fathers reported more solicitousness and promotion of well behaviour/coping than discouraging responses to their child's pain (all  $t(385) \geq |4.26|$ ,  $p < .0001$ ). Comparisons between parents indicated that mothers reported higher engagement in solicitous responses and promotion of well behaviour than fathers ( $t(385) = 8.12$ ,  $p < .0001$ , respectively,  $t(385) = 2.67$ ,  $p < .01$ ), whereas discouraging responses of mothers were significantly lower than those of fathers ( $t(385) = -4.26$ ,  $p < .0001$ ). Mean levels and differences between both parents are comparable with findings of mothers and fathers in another community sample of children and adolescents [24].

### Correlations

Of particular interest for the present study were the correlations between the child's pain catastrophizing, responses of mothers and fathers to their child's pain, and child-reported pain and disability (see Table 1). In general terms, both lower levels of solicitous responses and higher levels of discouraging responses tended to be associated with worse child outcomes; although this pattern was not consistently found in both fathers and mothers. Specifically, discouraging responses from the mother showed a small but significant positive correlation with the child's pain catastrophizing and pain intensity. Solicitous responses from



the mother showed a small negative correlation with child-reported pain intensity. For fathers, discouraging responses were not significantly correlated with any of the child-report measures. Solicitous responses from the father, however, showed a small but significant negative correlation with the child's pain catastrophizing and child-reported disability. Of further interest, and complementing other findings [see e.g. 13, 45, 48], the child's pain catastrophizing was positively correlated with both child-reported pain and disability.

- Insert Table 1 about here -

#### Value of the child's pain catastrophizing in explaining parental responses to their child's pain

A series of hierarchical regression analyses was conducted to examine the unique contribution of the child's catastrophizing in explaining mothers' and fathers' responses to their child's pain. Summaries of these analyses are presented in Table 2. In each analysis, the child's sex (girls coded as 0, boys coded as 1) and age were entered in step 1 to control for the effects of sociodemographic variables upon parental responses. In the second step, the child's pain intensity was entered. In the third step, the child's pain catastrophizing was entered. The variance-inflation factors of all six regression analyses were acceptable (range 1.03-1.08), suggesting that there was no problem of multicollinearity.

#### *The child's pain catastrophizing and mothers' responses to their child's pain*

The regression analyses with mothers' responses (i.e., solicitousness, discouragement or promotion of well behaviour/coping) revealed that for all three regression analyses, no significant effects were found of the child's age, sex or pain intensity (all  $|\beta|$ 's  $\leq .09$ , ns). The child's pain catastrophizing had a small but significant contribution in explaining mothers' discouraging responses, after controlling for the child's age, sex and pain intensity; higher levels of pain catastrophizing were associated with higher levels of mothers' discouraging responses ( $\beta=.11$ ;  $t=2.15$ ;  $p<.05$ ; 95% CI [.006;.14]). The child's catastrophizing did not

contribute to the explanation of solicitous responses ( $\beta=-.02$ ;  $t=-.37$ , ns; 95% CI [-.12;.08]) or promotion of well behaviour/ coping by mothers ( $\beta=.05$ ;  $t=.89$ , ns; 95% CI [-.04;.12]).

#### *The child's pain catastrophizing and fathers' responses to their child's pain*

For fathers, no significant effects of the child's age, sex or pain intensity (all  $\beta$ 's  $\leq$  |.08|, ns) were found upon solicitous and discouraging behaviours. However, for fathers' promotion of well behaviour/coping, there was a significant negative contribution of the child's age ( $\beta=-.15$ ;  $t=-2.85$ ;  $p<.01$ ) and a significant positive contribution of the child's pain intensity ( $\beta=.10$ ;  $t=1.99$ ;  $p<.05$ ). The child's pain catastrophizing had a small but significant contribution in explaining solicitous responses of fathers, after controlling for the child's age, sex and pain intensity; higher levels of catastrophizing were associated with lower levels of solicitous responses from fathers ( $\beta=-.11$ ;  $t=-2.23$ ;  $p<.05$ ; 95% CI [-.23;-.02]). The child's pain catastrophizing did not significantly contribute to the explanation of father-reported discouraging responses ( $\beta=.06$ ;  $t=1.19$ , ns; 95% CI [-.03;.11]) or promotion of well behaviour/coping ( $\beta=-.09$ ;  $t=-1.76$ ,  $p = .08$ ; 95% CI [-.15;.01]).

- Insert Table 2 about here -

#### Moderation of the catastrophizing-disability association by parental responses

To investigate whether the relationship between child's catastrophizing and functional disability was moderated by parental responses to their child's pain, additional regression analyses were performed; i.e. separate regression models were fitted for the child's disability, for each of the three types of parental responses. Moderation analyses were performed in line with the recommendations of Holmbeck [20; 21]. In the present study, four blocks of independent variables were entered hierarchically in each linear regression: (1) the child's age and sex, (2) the child's pain intensity, (3) child pain catastrophizing and either solicitousness, discouragement or promotion of well behaviour/coping and (4) the cross-product terms of the respective type of parental responses and pain catastrophizing. To reduce the effects of

multicollinearity, continuous variables were centered [1; 17; 21]. The variance-inflation factors of the moderation analyses were acceptable (range 1.01-1.10), suggesting that there was no problem of multicollinearity. Statistically significant interactions were interpreted by plotting regression lines for high (+1SD above the mean) and low (1 SD below the mean) values of the continuous moderator variable [1, 21]. Table 3 summarizes the results of the moderation analyses in explaining functional disability. Results on the moderating role of parental responses in the association between the child's pain catastrophizing and disability are presented below, first for mothers, than for fathers.

-Insert Table 3 about here -

#### Moderating role of mothers' responses

Moderation analyses with mothers' responses and child-reported disability revealed that, for all three regression analyses, the child's pain intensity and pain catastrophizing had a significant positive contribution in explaining the child's functional disability (mean  $\beta = .17$ ,  $p < .005$ , respectively mean  $\beta = .35$ ,  $p < .0001$ ). There were no significant main effects of mothers' responses (all  $\beta$ 's  $\leq |.07|$ , ns). Also, no significant interaction effects were found between the child's catastrophizing and mother-reported solicitousness ( $\beta = .04$ , ns; CI [-.007;.02]) or discouragement ( $\beta = -.03$ , ns; CI [-.03;.01]). However, there was a significant interaction effect for promotion of well behaviour/coping x child catastrophizing ( $\beta = -.10$ ,  $p < .05$ ;  $\Delta R^2 = .01$ ; Adjusted  $R^2 = .18$ ; 95% CI [-.03-.001]). To illustrate the pattern reflected in the statistically significant interaction term, we plotted regression lines for high (+1 SD above the mean) and low (-1 SD below the mean) values of the moderator variable [see e.g. 1, 19] (see Figure 1). Significance tests for both slopes indicated that both reached significance. The positive association between catastrophizing and disability, however, was less pronounced in case of high mother-reported promotion of well behaviour/coping ( $\beta = .23$ ,  $p < .01$ ), as compared to when mothers reported low promotion of well behaviour ( $\beta = .47$ ,  $p < .0001$ ),

suggesting that promotion of well behaviour may be most beneficial for children who highly catastrophize about pain. Indeed, additional analyses (see also Figure 1) revealed that higher promotion of well behaviour by mothers was associated with lower levels of disability, but only for children who highly catastrophize about pain ( $\beta = -.16, p < .05$ ) and not for children who report low levels of catastrophizing ( $\beta = .02, ns$ ).

- Insert Figure 1 about here -

#### Moderating role of fathers' responses

Similar moderation analyses as reported above were conducted to investigate the moderating role of father's responses in the relationship between catastrophizing and disability. Findings revealed that, for all three regression analyses, the child's pain intensity and pain catastrophizing had a significant positive contribution in explaining the child's functional disability (mean  $\beta = .17, p < .005$ , respectively mean  $\beta = .35, p < .0001$ ). Further, a significant negative contribution of father-reported solicitousness ( $\beta = -.10, t = -2.04, p < .05$ ) was found. The child catastrophizing x father-reported discouragement interaction proved to be non-significant ( $\beta = .06, ns$ ; CI [-.006;.03]). However, the interaction between child catastrophizing x father solicitousness ( $\beta = -.17, p < .0001$ ; CI [-.03;-.01];  $\Delta R^2 = .03$ ; Adjusted  $R^2 = .20$ ) and between child catastrophizing x father promotion of well behaviour/coping ( $\beta = -.10, p < .05$ ; CI [-.03;-.002];  $\Delta R^2 = .01$ ; Adjusted  $R^2 = .18$ ) were found to be significant. To illustrate the pattern reflected in the significant interaction of fathers' solicitousness  $\times$  catastrophizing, we plotted regression lines for high (+1 SD above the mean) and low (-1 SD below the mean) values of the moderator variable (see Figure 2). Significance tests for both slopes indicated that both regression lines reached significance. The positive association between catastrophizing and disability, however, was less pronounced in case of high father-reported solicitousness ( $\beta = .14, p < .05$ ) as compared to when fathers reported low solicitousness ( $\beta = .51, p < .0001$ ), suggesting that solicitousness from fathers may be most

beneficial for children who highly catastrophize about pain. Indeed, additional analyses (see also Figure 2) indicated that higher levels of solicitous responses by fathers were associated with lower levels of disability, but only when the child is high catastrophizing ( $\beta = -.28, p < .0001$ ). For children with lower levels of pain catastrophizing, fathers' solicitousness had no impact upon the child's disability ( $\beta = .09, ns$ ).

To illustrate the pattern reflected in the statistically significant interaction of fathers' promotion of well behaviour/coping  $\times$  catastrophizing, regression lines for high and low values of this moderator variable were again plotted (see Figure 3). Significance tests for both slopes indicated that both regression lines reached significance, but the positive association between catastrophizing and disability was less pronounced in case of high father-reported promotion of well behaviour/coping ( $\beta = .29, p < .0001$ ), as compared to when fathers reported low promotion of well behaviour ( $\beta = .47, p < .0001$ ). Further analyses (see also Figure 3) revealed that, similar to mothers' promotion of well behaviour/coping, also fathers' promotion of well behaviour/coping was particularly beneficial for children with high levels of pain catastrophizing; i.e promotion of well behaviour by fathers was negatively associated with disability, but only for children who reported high levels of catastrophizing ( $\beta = -.13, p < .05$ ), and not for children who reported low levels of catastrophizing ( $\beta = .05, ns$ ).

- Insert Figure 2 & 3 about here -

## **DISCUSSION**

The present study investigated the association of the child's catastrophizing with different types of parental responses (solicitousness, discouragement and coping promoting responses) and the extent to which parental responses moderate the association of child catastrophizing with disability. Analyses revealed small but significant associations between the child's catastrophizing and parental responses, yet with mothers and fathers evidencing different patterns. Specifically, higher levels of catastrophizing were associated with lower

levels of solicitousness, but only for fathers. In addition, a positive association was found between the child's catastrophizing and parental discouragement, yet only reaching significance for mothers. Further, moderation analyses indicated that fathers' solicitousness moderated the association between catastrophizing and disability. In particular, and contrary to expectations, the positive association between catastrophizing and disability became less pronounced when father-reported solicitousness was high. Finally, findings also revealed a moderating impact of fathers' and mothers' promotion of their child's coping. Specifically, high coping promoting responses of both parents diminished the detrimental impact of catastrophizing upon disability.

The present findings are in line with previous research indicating that catastrophizing may not always elicit solicitous responses [4, 5, 6, 19, 47]. Specifically, previous studies suggest that catastrophizing may be associated with discouraging responses as well [4; 19; 47]. As increased pain expression may be the vehicle through which catastrophizing impacts upon others [39, 41, 44, 46], this raises questions about the expression of pain by individuals who highly catastrophize about pain and how this affects others. For parents, it is likely that facing their child in pain may initially elicit positive attention or care. However, repeated exposure to elevated pain displays of their child – which is more likely when the child highly catastrophizes about pain - may also become an aversive experience and a source of frustration and distress [7; 32, 34]. The latter may become even more pronounced not only because of heightened expression of pain, but also by the specific *way* in which those who highly catastrophize are asking for help. This point is elegantly demonstrated by Cano and colleagues [7] in a study of adults with chronic pain and their spouse. The authors pointed out that those who highly catastrophize feel highly entitled to get support from others. Interestingly, support entitlement moderated the relationship between catastrophizing and spouse responses such that catastrophizing was positively associated with punishing and

invalidating responses for those reporting high support entitlement, but with greater solicitousness for those reporting low support entitlement. Particularly interesting is the authors' suggestion that those who feel highly entitled to support might be especially prone to indirect support seeking attempts. Unfortunately, indirect support seeking behaviours may be aversive to caregivers [38] and hence, give rise to critical or discouraging responses.

The importance of investigating the association between the child's catastrophizing and parental responses also follows from the impact parental responses may have upon the child's pain experience. In particular, the present findings suggest that children with higher levels of catastrophizing are, through its association with parental responses, more vulnerable for worse outcomes; i.e., high discouragement by mothers was associated with higher levels of pain, whereas low solicitousness by fathers further amplified the association between the child's catastrophizing and disability.

Interestingly, however, the present study indicated that parents may also respond in ways that protect the child from otherwise more detrimental effects of catastrophizing; i.e. the effects of catastrophizing became *less* adverse in case of high levels of solicitousness by fathers. Further, the negative effects of catastrophizing were also less pronounced in case of high promotion of well behaviour by both fathers and mothers. These findings are intriguing and challenge prevailing views. In particular, the finding that the effects of catastrophizing may not always be as detrimental, but dependent upon how parents respond to their child's pain also implies that the impact of parental responses cannot be conceived as being intrinsically part of the response. In fact, a priori categorizations about reinforcing or punishing qualities of parental responses under-represent the complexity of parent-child interactions [30; 51]. The present finding supports the idea, already suggested by Peterson and Palermo [36], that characteristics of the child in pain are important in understanding actual

consequences of parental responses; i.e. whether parental responses might be considered supportive/helpful or not.

One possible explanation is that particular types of responses, initially thought of having reinforcing qualities (e.g., solicitousness), may have a different meaning and impact depending on the extent to which they meet the needs of the child in pain. In support of this idea are findings from the general support literature where it has been well established that receiving support that matches one's desired type of support is most conducive to effective coping [2, 14]. In a similar vein, Holtzamn and Delongis [22] recently found, in a study in adults with chronic pain, that satisfaction with spouse support attenuates the detrimental effects of catastrophizing. To date, we do not know the very specific needs of children who catastrophize about pain, neither do we know whether provision of desired support would be beneficial to them. Yet, it is plausible that feeling supported may convey a sense of validation of the child's pain thereby altering emotion regulation processes and encouraging them to effectively engage in more adaptive coping strategies [8, 22, 25; 26]. Particularly parental promotion of the child's well behaviour/ coping (e.g., use of humor or distraction) and fathers' solicitousness appears promising in this regard.

Finally, the current study emphasizes the importance of including fathers into pain research and management. Various types/levels of parental responses, particularly those of fathers, appear to protect the child from otherwise more detrimental effects of catastrophizing. Why fathers' responses may make the difference is unclear. Yet, these findings are comparable with findings from the child anxiety literature where there is strong evidence that paternal involvement, more than maternal involvement, promotes competence and protects against distress [3]. One potential explanation is that children who catastrophize about pain may put highest weight on fathers' responses in the face of possible threat; i.e the anticipation or experience of pain [3]. Alternatively, mothers' and fathers' specific way of engaging into



particular types of responses (i.e., solicitousness) may also differ. For example, variability in both the emotional tone and other non-verbal characteristics (such as parent facial expression of emotions) might explain why similar types of responses may have a different impact and/or show a counterintuitive relationship with child pain outcomes. Findings indicating that solicitous spouse responses can be delivered with hostility [31] or that responses such as parental reassurance may serve as a signal of parental fear to the child [28] are in support of this idea. In addition, and further corroborating this notion, it is also plausible that the impact of parental responses may vary as a function of the sequence or co-occurrence of different responses used. For example, the impact of promotion of well behaviour may differ when preceded by solicitous responses than when preceded by discouraging responses.

Our findings must be interpreted in the context of several limitations. First, the study sample consisted of a convenient sample of school children and their parents. Hence, findings cannot be generalized to the general population or to children with chronic or clinical pain and their parents. Second, findings were based on cross-sectional questionnaires not allowing causal inferences. Longitudinal studies assessing (interpersonal) antecedents and consequences of pain catastrophizing are needed to shed light on the origins of catastrophizing as well as on factors contributing to its persistence and pervasive effects. Third, although the current study enlarged our understanding on the role of a broader range of parental responses, it is still limited in its focus as parents may engage in a much broader response repertoire than assessed in the present study. In addition, parents are also likely to vary in the way they engage in certain types of responses. Observational studies assessing non-verbal characteristics and verbal content of parent-child interactions are promising and may further enrich our understanding of mother-father differences in responding to their child's pain [see e.g. 52]. Finally, various measures have been developed to assess similar types of parental responses to the child's pain [10; 19]. This may compromise comparability

between study findings. Further research is needed investigating how IRPEDNA relates to other measures tapping into parental responses to the child's pain.

In spite of these limitations, the current findings extend our understanding of how catastrophizing may impact paediatric pain by considering the role of parents. Specifically, the present study attests to the importance of assessing and targeting parental responses to their child's pain since these may alter the adverse impact of the child's pain catastrophizing upon pain outcomes, such as the child's disability. Further research is needed to investigate the specific needs of children who catastrophize, the unique way these are manifested into behaviour, responded to by others and how, in turn, parental behaviours actually impact upon the child's pain.

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## FIGURE LEGENDS

Figure 1: Regression lines for the relationship between the child's Pain catastrophizing and Disability as moderated by Mothers' (M) promotion of well behaviour/coping. Standardized Beta's ( $\beta$ ) are shown.

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

Figure 2: Regression lines for the relationship between the child's Pain catastrophizing and Disability as moderated by Fathers' (F) solicitousness. Standardized Beta's ( $\beta$ ) are shown.

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

Figure 3: Regression lines for the relationship between the child's Pain catastrophizing and Disability as moderated by Fathers' (F) promotion of well behaviour/coping. Standardized Beta's ( $\beta$ ) are shown.

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

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Table 1

Means (M), Standard deviations (SD), and Pearson correlations of pain catastrophizing, pain intensity, functional disability, and mothers' and fathers' responses to their child's pain ('solicitousness', 'discouragement' and 'promotion of well-behaviour/coping')

	<b>Range</b>	<b>M (SD)</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
1. Pain catastrophizing	0- 52	12.47 (8.00)	.22**	.24**	-.05	.12*	.04	-.11*	.05	-.09 <sup>(*)</sup>
2. Pain intensity	0-100	50.17 (29.11)	--	.24**	-.11*	.10*	-.04	.05	.001	.08
3. Functional disability	0-60	6.46 (7.82)		--	-.07	.02	-.06	-.12*	.08	-.08
4. Solicitousness – M	0-4	2.45 (.53)			--	-.22**	.39**	.34**	-.10 <sup>(*)</sup>	.17*
5. Discouragement - M	0-4	1.15 (.52)				--	.22**	-.16*	.27**	.02
6. Promotion of well behaviour/coping – M	0-4	2.39 (.52)					--	.11*	.12*	.22**
7. Solicitousness – F	0-4	2.19 (.56)						--	-.21**	.51**
8. Discouragement – F	0-4	1.29 (.51)							--	.19**
9. Promotion of well behaviour/coping - F	0-4	2.31 (.52)								--

<sup>(\*)</sup> p < .08; \* p < .05; \*\* p < .0001

M = mother report / F = father report

Table 2

Hierarchical regression analysis explaining parental solicitousness, parental discouragement and parental promotion of well behaviour/coping as rated by the mother and the father separately. Standardized betas from the last step in the analyses are displayed.

Criterion variable	Step	Predictor	Mother			Father		
			$\beta$	R <sup>2</sup> Change	Adj R <sup>2</sup>	$\beta$	R <sup>2</sup> Change	Adj R <sup>2</sup>
Solicitousness	1	Age	-.07	.01	.001	-.08	.01	.01
		Sex	.02			.04		
	2	Pain intensity	-.10	.01	.01	.07	.00	.01
Discouragement	1	Age	-.08	.01	.00	-.03	.00	.00
		Sex	-.01			.06		
	2	Pain intensity	.08	.01	.01	-.01	.00	.00
Promotion of well behaviour/coping	1	Age	-.06	.01	.00	-.15**	.03*	.03
		Sex	-.04			.04		
	2	Pain intensity	-.05	.00	.00	.10*	.01	.03
	3	Pain catastrophizing	.05	.00	.00	-.09 <sup>(*)</sup>	.01	.03

<sup>(\*)</sup> p = .08; \* p < .05; \*\* p < .01

Table 3

Moderation analysis explaining child-reported functional disability. Standardized betas from the last step in the analyses are displayed.

Criterion variable	Step	Predictor	Mother			Father		
			$\beta$	R <sup>2</sup> Change	Adj R <sup>2</sup>	$\beta$	R <sup>2</sup> Change	Adj R <sup>2</sup>
Disability	1	Age	-.01	.01	.00	-.02	.01	.002
		Sex	-.03			-.02		
	2	Pain intensity	.16**	.06***	.06	.18***	.06***	.06
	3	Pain catastrophizing	.35***	.11***	.17	.33***	.12***	.17
		Solicitousness	-.04			-.10*		
	4	Pain catastrophizing × solicitousness	.04	.00	.17	-.17***	.03***	.20
	1	Age	-.01	.01	.002	-.01	.01	.002
		Sex	-.03			-.03		
	2	Pain intensity	.17**	.06***	.06	.17**	.06***	.06
	3	Pain catastrophizing	.35***	.11***	.17	.35***	.12***	.17
		Discouragement	-.04			.06		
	4	Pain catastrophizing × discouragement	-.03	.001	.17	.06	.003	.17
1	Age	-.02	.01	.002	-.02	.01	.002	
	Sex	-.03			-.03			
2	Pain intensity	.17***	.06***	.06	.18***	.06***	.06	
3	Pain catastrophizing	.35***	.12***	.17	.34***	.12***	.17	
	Promotion of well behaviour/coping	-.07			-.06			
4	Pain catastrophizing × promotion of well behaviour/coping	-.10*	.01*	.18	-.10*	.01*	.18	

\*  $p < .05$ ; \*\*  $p < .005$ , \*\*\*  $p < .0001$

Figure 1

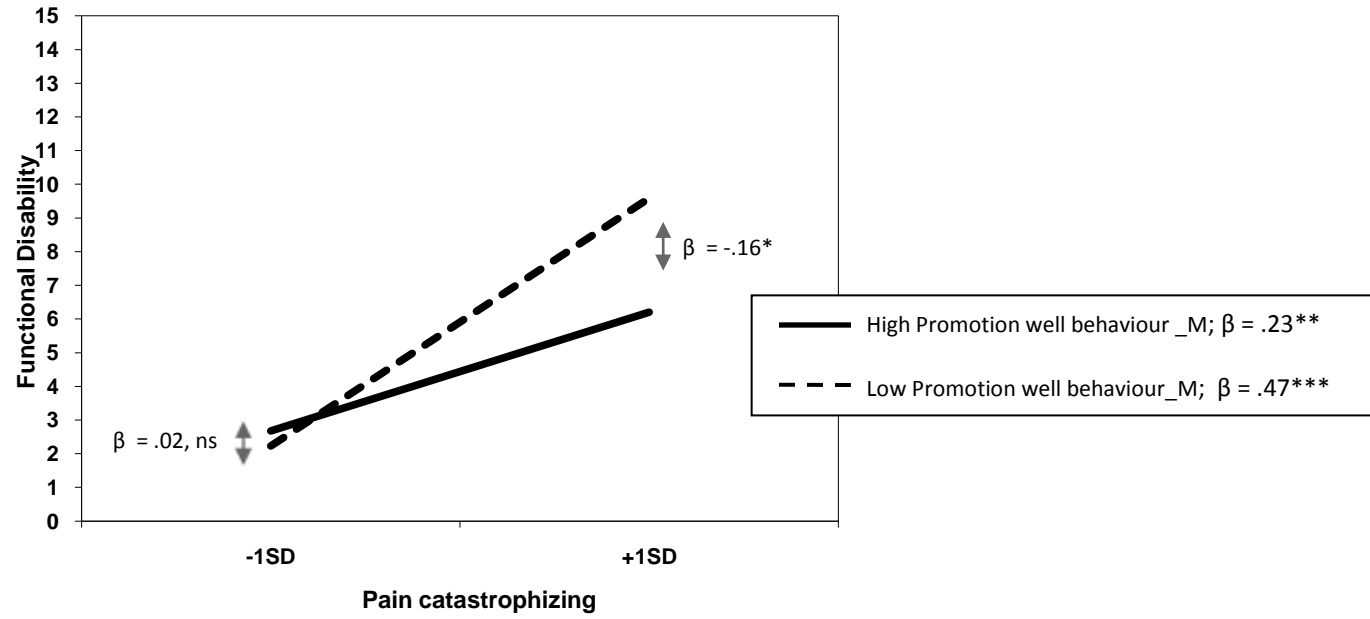


Figure 2

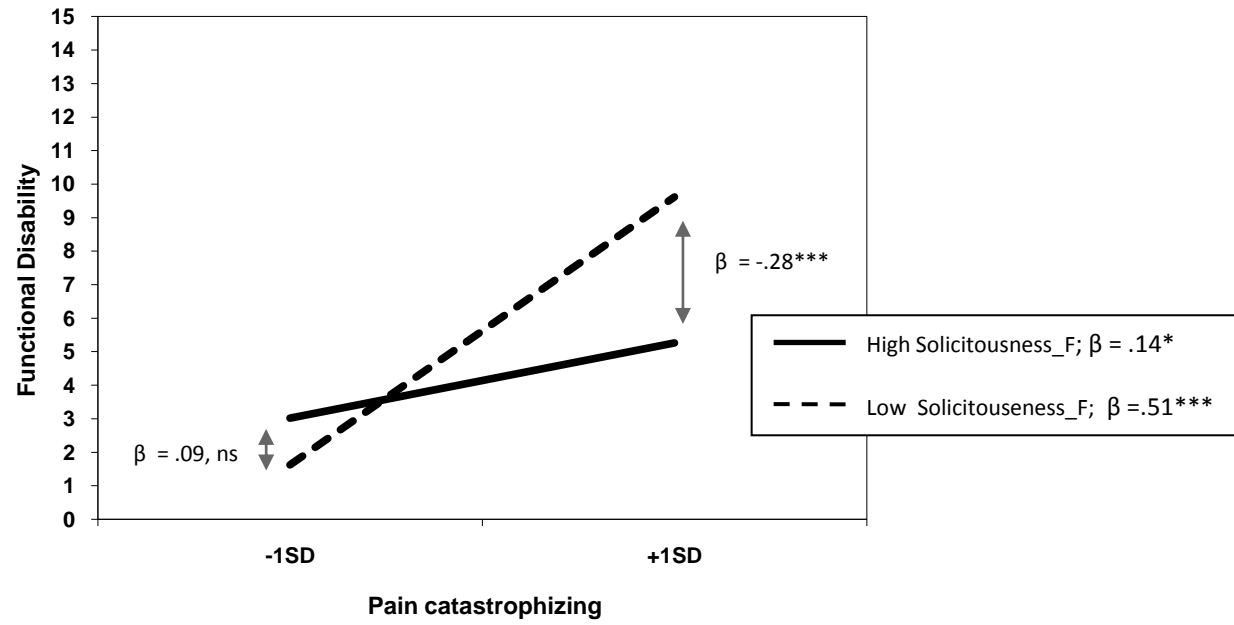


Figure 3

