Pain catastrophizing predicts verbal expression among children with chronic pain and their mothers

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Abstract

This study examined intra- and inter-personal associations between pain catastrophizing and verbal expression in 70 children with recurrent abdominal pain and their mothers. Participants independently completed the Pain Catastrophizing Scale. Mothers and children then talked about the child's pain. Speech was categorized using a linguistic analysis program. Catastrophizing was positively associated with the use of negative emotion words by both mothers and children. In addition, mothers' catastrophizing was positively associated with both mothers' and children's anger word usage, whereas children's catastrophizing was inversely associated with mothers' anger word usage. Findings extend the literature on behavioral and interpersonal aspects of catastrophizing.

Keywords

catastrophizing, children, communication, emotions, pain

Introduction

> "It is not death or pain that is to be dreaded, but the fear of pain or death." (Epictetus, Greek philosopher, AD 55–135)
> "… for there is nothing either good or bad, but thinking makes it so." (Hamlet, Act 2, Scene 2)

As the above quotes illustrate, how we think about negative experiences such as pain plays a central role in our experience of them, potentially more so than the physical sensations of pain. Indeed, the notion of pain catastrophizing has received a great deal of attention and research investigation. Pain catastrophizing is characterized as an appraisal of pain as highly threatening, dangerous, or as beyond one's ability to cope (Sullivan et al., 2001). For example, recurrent headaches might be interpreted as a sign of life-threatening disease, with no clear evidence of such. Numerous studies have demonstrated a link between pain catastrophizing and pain intensity, pain-related dysfunction, psychological distress, and pain behavior (the outward expression of pain such as limping or complaining; Quartana et al., 2009).

Pain catastrophizing among children has been associated with a variety of negative outcomes including increased pain intensity, depression, anxiety and functional disability (difficulty doing routine activities), and decreased quality of life (Eccleston et al., 2004; Langer et al., 2009; Lynch-Jordan et al., 2010; Vervoort et al., 2006). Pain catastrophizing among children has also been linked to children's expression of pain, for example, grimacing or guarding the painful area (Lynch-Jordan et al., 2010; Vervoort et al., 2008a, 2009). One critique of studies examining associations between catastrophizing and pain behavior, though, is that the behavior is typically assessed using subjective questionnaire-based methods (Lynch-Jordan et al., 2010; Vervoort et al., 2008a) rather than through direct observation. In addition, in some cases, both constructs (catastrophizing and pain behavior) are assessed through questionnaires completed by the same person, thereby increasing the likelihood of association. Some studies have

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attempted to address these shortcomings by utilizing direct observation to measure pain behavior in the laboratory (Vervoort et al., 2008b, 2009). However, to our knowledge, no study has examined the association between catastrophizing and objectively assessed behavior in the context of pain-related conversations between parents and children or in settings in which pain is not induced.

Parents play a key role in children's pain behavior. They affect how children respond to their pain, and whether they minimize or exaggerate it. Parents' responses to children's pain, particularly those actions that may reinforce child illness behavior by attending to symptom complaints and encouraging avoidance of school or other activities, have been positively associated with symptom reports, functional disability, and school absences (Levy, 2011; Levy et al., 2004; Walker et al., 2006a). Parents' *thoughts* also play an important role in shaping their emotional and behavioral reactions to their children's pain. The construct of catastrophizing has been applied not just to persons experiencing pain but also to significant others, spouses of persons with chronic pain (Cano et al., 2005) and parents of children with pain (Goubert et al., 2006). Parents' catastrophizing about their child's pain, viewing the pain as a sign of harm or damage or as beyond the child's ability to cope, has been associated with increased parental distress during clinic-based procedures (Caes et al., 2014) and increased solicitous responding to the child's pain, that is, responding in ways that reinforce child pain behavior (Hechler et al., 2011). What is not clear, however, is how parental catastrophizing about child pain might be reflected in communication between parent and child about the pain, particularly in the language used by both parties to describe and make sense of the child's condition.

To address this question, we draw from research on emotional expression. Reviews of studies designed to examine the effects of emotional disclosure indicate that writing or speaking about a stressful or traumatic event or condition is associated with a variety of mental and physical health benefits (Frattaroli, 2006; Smyth, 1998). The mechanism by which this kind of disclosure is linked to health benefits is still under debate, but one school of thought suggests that disclosure facilitates mental processing of the event. Indeed, participants who benefited most from experimentally induced journaling used more words indicative of causation and insight over the course of writing, presumably allowing them to make sense of the event and integrate it into their self-concept (Pennebaker, 1993). Other studies demonstrated greater benefit among those using a high number of positive emotion words and a moderate number of negative emotion words (Frattaroli, 2006).

In this study, we sought to examine associations between pain catastrophizing and pain-related verbal expression among children with unexplained recurrent abdominal pain and their mothers. Pediatric abdominal pain is a pain condition that is quite prevalent, with one in three children

reporting weekly abdominal pain (Saps et al., 2009). Medical evaluations typically yield no evidence of organic disease, leading to a diagnosis of functional abdominal pain (FAP). The disorder has a worldwide pooled prevalence of 13.5 percent (Korterink et al., 2015) and is associated with significant personal and societal costs: anxiety, depression, missed school days, and healthcare utilization among children (Campo et al., 2004; Crushell et al., 2003; Hyams et al., 1996; Roth-Isigkeit et al., 2005), and anxiety, depression, somatic symptoms, decreased quality of life, and increased healthcare utilization among *mothers* of children with FAP (Campo et al., 2007). Furthermore, children with FAP are at risk for continued symptoms, distress, and functional disability as they transition to adulthood (Shelby et al., 2013; Walker et al., 1995).

Given the pervasive maladaptive effects of catastrophizing in the literature, we predicted that catastrophizing would be associated with the utterance of more negative emotion words and the utterance of fewer cognitive process words among both mothers and children (within-person associations). The prediction about negative emotion words was based on the negative mindset characteristic of catastrophizing. The prediction about cognitive process words was based on the rationale that catastrophizing might be reflected in language indicative of reduced or inefficient processing of the pain condition. Unlike most research on emotional expression, we sought to examine these processes in the context of a conversation between mothers and children about the child's pain. This afforded the ability to examine associations between both mothers' and children's catastrophizing and their verbal behavior during the interaction.

Method

Participants

Seventy children with FAP and their mothers served as participants, recruited from the gastroenterology outpatient clinic of Seattle Children's Hospital. They were recruited for an observational study involving a pain induction procedure whereby children were asked to drink water to satiety, a valid and safe provocation known to induce temporary abdominal discomfort (Walker et al., 2006b). Importantly, all procedures described herein *preceded* the pain induction procedure. Potentially eligible patients were identified based on medical records and lists of upcoming clinic visits for abdominal pain. The clinical research associate conducting this screening informed providers of any potentially eligible patients they would be seeing. If, during the clinic visit, a diagnosis of FAP was made or confirmed, the provider mentioned the study to the family. If the family expressed interest, the clinical research associate was then invited to discuss the study in depth with the parent and child, describing the study purpose, procedure, risks, and

benefits. This was done either right then and there in the clinic if time afforded or later by phone. Accordingly, informed consent and assent were obtained either in the clinic or in the laboratory on the day of the study visit (if the approach was made by phone).

Eligible children were aged 7–12 years, diagnosed by a pediatric gastroenterologist as having FAP, and able to speak and comprehend English. Exclusion criteria were positive physical or laboratory findings explicative of the child's abdominal pain and chronic disease such as diabetes, cancer, or inflammatory bowel disease. Eligible mothers were aged 18 years or older and able to speak and comprehend English.

Procedure

Dyad-based sessions took place in the Pediatric Clinical Research Center at Seattle Children's Hospital. Upon arrival, mothers and children were asked to independently complete a battery of questionnaires, including those listed below. Mothers completed pencil-and-paper questionnaires, while an experimenter orally administered questionnaires to children in a separate room. Children were shown laminated copies of response options to aid administration. Mothers and children were then reunited and asked to converse for 10 minutes about the child's abdominal pain condition. A list of three discussion topics was provided to facilitate the conversation: (1) the child's most recent abdominal pain episode, (2) times when the pain is worse than others, and (3) activities that might be missed due to pain such as school, sports, or time with friends. Conversations were recorded. All procedures were approved by the Institutional Review Board of Seattle Children's Hospital.

Questionnaires

Child pain. The Faces Pain Scale–Revised (Hicks et al., 2001) was used to assess child pain intensity. This is a single-item self-reported measure. Children are shown a row of six line-drawn faces. The left-most face depicts no pain, with the faces depicting more and more pain as they move from left to right. Children in this study were instructed to choose the face that shows "how much their stomach hurts right now." Options were scored as 0 (*no pain*) to 10 (*very much pain*). The developers reported validity per strong positive correlations with pain ratings using a visual analog scale and a colored analog scale, the former in the context of ear piercing and the latter during hospitalization (Hicks et al., 2001).

Child pain catastrophizing. The Pain Catastrophizing Scale–Child (PCS-C) was used to assess child trait pain catastrophizing (Crombez et al., 2003). Thirteen items such as "When I have pain, I can't keep it out of my mind" are rated on a 0–4 (*not at all* to *extremely*) scale. The scale contains three factor analytically derived subscales: rumination, magnification, and helplessness. We focus here on total scores which can range from 0 to 52 with higher values indicative of greater catastrophizing. The developers reported strong internal consistency ($\alpha = 0.87$) and validity per positive associations with measures of child anxiety, pain intensity, and functional disability (Crombez et al., 2003). Cronbach's coefficient alpha based on the present sample was 0.93.

Maternal catastrophizing about child pain. The Pain Catastrophizing Scale-Parent (PCS-P) was used to assess the extent to which mothers catastrophize about their child's pain (Goubert et al., 2006). Thirteen items parallel to the PCS-C such as "I worry all the time whether my child's pain will end" are rated on a 0–4 (*not at all* to *extremely*) scale. As with the PCS-C, we focus here on total scores which can range from 0 to 52. The developers reported strong internal consistency ($\alpha = 0.93$) and validity per positive associations with parental distress and child functional disability, and an inverse association with child school attendance (Goubert et al., 2006). Cronbach's coefficient alpha based on the present sample was 0.91.

Data reduction in mother–child conversations

Digital recordings of mother–child conversations were transcribed by a professional transcriptionist. Transcribed files were decomposed to extract separate utterances made by children and mothers. Child and mother files were then submitted to linguistic analysis using the Lexical Inquiry and Word Count (LIWC) system (Pennebaker et al., 2007). This computerized program outputs data for over 65 different linguistic dimensions spanning five broad categories ranging from linguistic processes such as word count and present tense to psychological processes. We focus here on dimensions within the psychological processes category: cognitive processes (exemplar words include *cause*, *ought*, and *know*) and affective processes, specifically negative emotion words such as *hurt*, *sad*, and *nasty*. The negative emotion dimension contains three subcategories: anxiety words (*worried, fearful*, and *nervous*), anger words (*hate* and *annoyed*), and sad words (*crying, grief*, and *sad*). The system outputs data as the percentage of words within each category, thus taking into account the overall number of words uttered by a given participant. Validity of the system is supported by studies comparing LIWC-derived values to judgments made by objective coders (Bantum and Owen, 2009; Pennebaker et al., 1997), with sensitivity and specificity for emotional expression words determined to be 0.88 and 0.97, respectively (Bantum and Owen, 2009).

Statistical analysis

Statistical analyses were conducted using SPSS 23.0. Multilevel modeling with restricted maximum likelihood

Table 1. Demographic characteristics of the sample.

	Children (*N* = 70)	Mothers (*N* = 70)
Age, *M* (*SD*); range	9.56 (1.66)	40.36 (7.91)
Gender, *n* (%)		
Female	48 (68.6)	70 (100.0)
Male	22 (31.4)	0 (0.0)
Ethnicity, *n* (%)		
Hispanic	9 (12.9)	7 (10.0)
Not Hispanic	60 (85.7)	63 (90.0)
Unknown	1 (1.4)	0 (0.0)
Race, *n* (%)		
American Indian/Alaska Native	1 (1.4)	2 (2.9)
Asian	4 (5.7)	4 (5.7)
Black or African American	1 (1.4)	1 (1.4)
White	49 (70.0)	56 (80.0)
More than one race	11 (15.7)	6 (8.6)
Unknown	4 (5.7)	1 (1.4)
Education, *n* (%)		
High school degree or GED	–	7 (10.0)
Some college or technical school	–	32 (45.7)
4-year college degree	–	15 (21.4)
Post-baccalaureate degree	–	16 (22.9)
Marital status, *n* (%)		
Married	–	54 (77.1)
Cohabiting with partner	–	5 (7.1)
Single/widowed/separated/divorced	–	11 (15.7)
Employment status, *n* (%)		
Not employed	–	30 (42.9)
Employed part-time	–	20 (28.6)
Employed full-time	–	19 (27.1)
Unknown	–	1 (1.4)

SD: standard deviation; GED: general educational development.

was used to estimate an actor–partner interdependence model (APIM) assessing the effects of role (mother or child) and catastrophizing on the percentage of cognitive process and negative emotion words uttered during the discussion. The APIM estimates two effects: actor and partner effects (Kenny et al., 2006). The actor effect represents the association between a predictor and an outcome *within* an individual (e.g. mother's catastrophizing and mother's verbal expression), whereas the partner effect represents the association between a predictor and an outcome *across* dyad members (e.g. mother's catastrophizing and child's verbal expression). Cross-product terms are added to test for interactions. All models controlled for child-reported pain intensity.

Results

Self-reported and behavioral characteristics of the sample

Table 1 presents demographic characteristics of the sample. Children were aged, on average, 9.6 years and mothers

aged 40.4 years. In keeping with the general population of children with FAP, the majority was female (69%). Per maternal report, 70 percent of children and 80 percent of mothers were White, and 13 percent of children and 10 percent of mothers were Hispanic. In addition, 77 percent of mothers were married, 44 percent had earned a 4-year college degree or higher, and just under one-quarter reported working full-time.

Table 2 presents descriptive characteristics of all covariate, predictor, and criterion variables. Child-reported current pain intensity ratings ranged from 0 to 10 but averaged 2.3, well below the scale midpoint. The mean for the child catastrophizing variable, 21.03, was on par with that reported by the scale developer based on a sample of children with chronic or recurrent pain (*M* = 21.88; Crombez et al., 2003). The mean for the parent catastrophizing variable, 18.50, was above the mean reported by the scale developers based on a sample of parents of school children (*M* = 15.67) and considerably below the mean for a sample of parents of children with chronic pain (*M* = 29.49; Goubert et al., 2006).

Table 2. Descriptive characteristics of self-reported and LIWC-derived variables.

	Children (N=70)	Mothers (N=70)	Norms[a]
Child pain intensity	2.27 (2.17); 0–10	–	–
Pain catastrophizing	21.03 (12.19); 0–48	18.50 (10.28); 2–45	–
Words uttered			
Total number words	503.43 (258.36); 136–1164	757.50 (250.65); 145–1322	13,580 (12,203)
% Cognitive process words	18.24 (3.64); 9.52–26.55	16.97 (2.69); 11.34–23.11	15.37 (2.85)
% Negative emotion words	3.00 (1.60); 0.41–9.31	4.30 (1.54); 1.19–10.55	1.63 (0.91)
% Anxiety words	0.30 (0.55); 0.00–3.91	0.31 (0.40); 0.00–2.40	0.33 (0.33)
% Anger words	0.13 (0.26); 0.00–1.22	0.14 (0.20); 0.00–0.79	0.47 (0.48)
% Sad words	1.44 (0.96); 0.00–5.10	2.25 (1.19); 0.40–6.33	0.37 (0.37)

Values represent *M* (*SD*); range.
LIWC: Lexical Inquiry and Word Count; *SD*: standard deviation.
[a]These values are listed on the LIWC (2007) website. http://www.liwc.net/howliwcworks.php#index7

Table 2 also lists descriptive characteristics of the LIWC-derived variables. The percentage of cognitive process words uttered was 17 percent for mothers and 18 percent for children. Percentages for the negative emotion words were lower, ranging from 0.13 percent for anger words uttered by children to 4.3 percent for total negative emotion words uttered by mothers. To put these values in perspective, we include normative data on base rates of word usage available on the LIWC website spanning multiple sources: emotional writing, control writing, science articles, blogs, novels, and talking in the context of observational studies. These normative values are based on the utterances of over 24,000 writers or speakers and totaling over 168 million words (Pennebaker et al., 2007). Of note, a subset of both mothers and children in our study did not utter any words indicative of anxiety, anger, or sadness. Specifically, 27.1 percent of mothers and 50 percent of children did not utter any anxiety words, 48.6 percent of mothers and 68.6 percent of children did not utter any anger words, and 1.4 percent of mothers and 4.3 percent of children did not utter any sad words. Norms for children are difficult to find. One study examined the linguistic content of children's utterances when talking about true and fabricated stressful and non-stressful scenarios (Brunet et al., 2013). The researchers did not report descriptive statistics for the subcategory of anger words but mean values and standard deviations (*SD*s) for the larger category of negative emotion words were 2.10 (1.17) for the true stressful scenario (describing a bullying event) and 1.07 (0.88) for the true non-stressful scenario (describing a sports event). These values fall below our child sample mean of 3.00.

Predictors of word usage

Main effects of role. The results of the regression models are presented in Table 3. Main effects of role emerged for three of the criterion variables. Mothers uttered fewer cognitive process words as compared to children (*p*<.01). They also uttered more negative emotion words as compared to children (*p*<.001), including more sad words (*p*<.001).

Main effects of catastrophizing. Catastrophizing was positively associated with the utterance of negative emotion words (*p*<.01). In other words, those higher in catastrophizing uttered more negative emotion words than did those lower in catastrophizing, regardless of role. Other main effects of catastrophizing reached marginal statistical significance. Specifically, catastrophizing was inversely associated with the utterance of cognitive process words (*p*=.103) and positively associated with the utterance of anxiety (*p*=.085) and sad words (*p*=.093), again regardless of role.

Role × catastrophizing interactions. The results for anger emotion words were more complex. The analysis for this criterion variable yielded a significant role × actor catastrophizing interaction (*p*<.05). The nature of this interaction is depicted in Figure 1. For children, catastrophizing was unassociated with the use of anger words (open circle), *b*=−0.02, *p*=.55. For mothers, in contrast, the association between catastrophizing and the use of anger words was positive (solid black square), *b*=0.07, *p*=.014; mothers higher in catastrophizing uttered more anger words than did mothers lower in catastrophizing.

The analysis also yielded a significant role × partner catastrophizing interaction, *p*<.05 (see Figure 2). For children, their mother's catastrophizing tended to be positively associated with their own use of anger words (open circle), *b*=0.06, *p*=.16. Children with mothers who were higher on catastrophizing tended to utter more angry words than children with mothers who were lower on catastrophizing. For mothers, their child's catastrophizing tended to be inversely associated with their own use of anger words (solid black square), *b*=−0.04, *p*=.12. Mothers with children who were higher on catastrophizing tended to utter *fewer* angry words than mothers with children who were lower on catastrophizing.

Table 3. Results of actor–partner interdependence model analyses predicting verbal expression.

	b (SE)	t	p	95% CI
Cognitive process words				
Intercept	16.72 (0.44)			
Child-reported pain intensity	0.39 (0.14)	2.77	.007	0.11, 0.67
Role (−1 child, 1 mother)	−0.63 (0.23)	−2.81	.006	−1.08, −0.18
Actor catastrophizing	−0.50 (0.30)	−1.64	.103	−1.10, 0.10
Partner catastrophizing	−0.51 (0.32)	−1.58	.118	−1.15, 0.13
Role × actor catastrophizing	0.13 (0.32)	0.39	.695	−0.51, 0.77
Role × partner catastrophizing	−0.04 (0.34)	−0.13	.897	−0.72, 0.63
Negative emotion words				
Intercept	3.62 (0.20)			
Child-reported pain intensity	0.01 (0.07)	0.17	.869	−0.12, 0.15
Role (−1 child, 1 mother)	0.65 (0.12)	5.28	.000	0.41, 0.90
Actor catastrophizing	0.50 (0.15)	3.28	.001	0.20, 0.81
Partner catastrophizing	−0.03 (0.15)	−0.21	.838	−0.34, 0.27
Role × actor catastrophizing	0.05 (0.16)	0.29	.775	−0.27, 0.36
Role × partner catastrophizing	0.15 (0.16)	0.96	.339	−0.16, 0.47
Anxiety words				
Intercept	0.27 (0.06)			
Child-reported pain intensity	0.01 (0.02)	0.58	.563	−0.03, 0.05
Role (−1 child, 1 mother)	0.01 (0.04)	0.21	.835	−0.07, 0.08
Actor catastrophizing	0.08 (0.05)	1.74	.085	−0.01 0.17
Partner catastrophizing	−0.07 (0.05)	−1.47	.145	−0.17, 0.03
Role × actor catastrophizing	−0.0004 (0.05)	−0.01	.993	−0.10, 0.10
Role × partner catastrophizing	0.03 (0.05)	0.54	.591	−0.07, 0.13
Sad words				
Intercept	2.00 (0.15)			
Child-reported pain intensity	−0.07 (0.05)	−1.45	.153	−0.17, 0.03
Role (−1 child, 1 mother)	0.40 (0.08)	5.00	.000	0.24, 0.56
Actor catastrophizing	0.19 (0.11)	1.69	.093	−0.03, 0.40
Partner catastrophizing	0.07 (0.11)	0.67	.506	−0.14, 0.28
Role × actor catastrophizing	−0.01 (0.11)	−0.13	.897	−0.24, 0.21
Role × partner catastrophizing	0.15 (0.11)	1.31	.194	−0.08, 0.37
Anger words				
Intercept	0.10 (0.03)			
Child-reported pain intensity	0.02 (0.01)	1.57	.121	−0.004, 0.04
Role (−1 child, 1 mother)	0.005 (0.02)	0.28	.781	−0.03, 0.04
Actor catastrophizing	0.03 (0.02)	1.21	.228	−0.02, 0.07
Partner catastrophizing	0.01 (0.02)	0.33	.743	−0.04, 0.05
Role × actor catastrophizing	0.05 (0.02)	2.05	.043	0.002, 0.09
Role × partner catastrophizing	−0.05 (0.02)	−2.01	.047	−0.10, −0.0006

SE: standard error; *CI*: confidence interval.

Discussion

The results of this observational study showed differences as well as similarities in the verbal behaviors of children with FAP and their mothers when discussing the child's chronic abdominal pain and associations with catastrophizing. Main effects of role indicated that mothers uttered fewer cognitive process and more negative emotion words than did children. While both mothers and children fell above the normative values listed for cognitive process words (Table 2), this asymmetry is interesting and requires replication and further research into possible mechanisms that may underlie this finding.

Our hypothesis regarding the intrapersonal association between catastrophizing and cognitive process words was not borne out, although the trend was in the expected direction. Persons higher in catastrophizing tended to utter fewer cognitive process words than did persons lower in catastrophizing. In *line* with prediction, catastrophizing was positively associated with the utterance of negative emotion words. This was true for both mothers and children and extends our knowledge of the
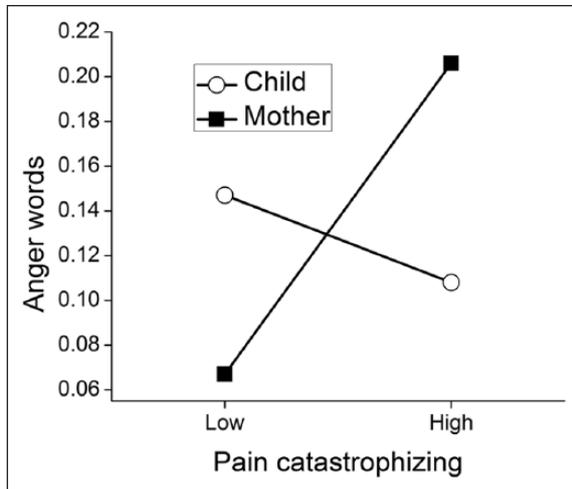
Figure 1. Predicted anger words uttered for children and mothers scoring 1 SD above or below the mean on pain catastrophizing: actor × role interaction.
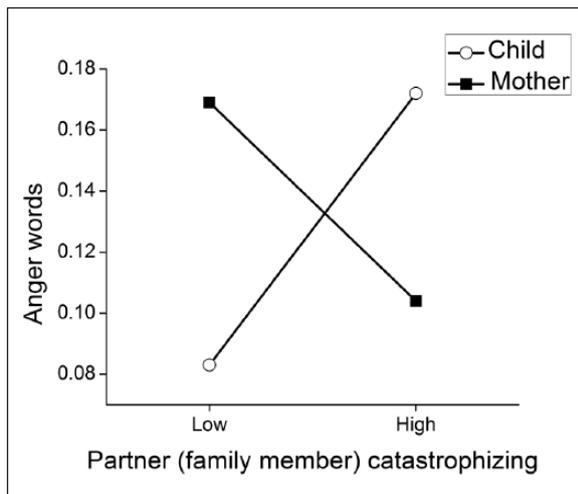
Figure 2. Predicted anger words uttered for children and mothers scoring 1 SD above or below the mean on pain catastrophizing: partner × role interaction.

behavioral correlates of catastrophizing among not just those experiencing pain but significant others as well. In keeping with research noting that catastrophizing is associated with greater pain expression (Quartana et al., 2009), the results of this study suggest that catastrophizing may be associated with negatively toned verbal interactions about pain. This could be maladaptive if it interferes with pain coping. Further work is needed to clarify directionality (whether catastrophizing leads to negative affect talk or vice versa) and to identify mechanisms by which catastrophizing and verbal expression are linked. For example, does catastrophizing directly affect negative emotional talk or is this mediated by increases in negative emotional experience? Unfortunately, we did not assess affective

state during the conversation so cannot explore these hypothetical paths.

Findings regarding the verbal expression of anger are of interest. A role × actor interaction indicated that catastrophizing was positively associated with anger expression among mothers but not children. Note, though, that the rates of anger expression were quite low, 0.13 percent for children and 0.14 percent for mothers, and that the base rates of anger word usage in general are low (0.47% of words per the LIWC website). They are double, however, that reported in a study of 187 mothers of sickle cell carrier infants, $M = 0.07$ percent (Ahmad and Farrell, 2014). It is possible that FAP, a disorder for which there is no organic cause, is particularly frustrating for parents, relative to a much more serious condition for which the etiology is understood. Partner effects were also observed, but the nature of these effects differed by role. Children of mothers higher in catastrophizing were more likely to utter anger words when talking about their abdominal pain than were children of mothers lower in catastrophizing. Mechanisms that might account for this finding are not clear. Catastrophizing, a cognitive construct, is not observable per se and cannot *directly* influence another's behavior. Instead, maternal catastrophizing is likely to indirectly affect child behavior through maternal behavior. Per the Emotions as Social Information model, emotional expressions influence an observer's behavior through affective and/or inferential paths (Van Kleef, 2009). For example, the expression of anxiety could elicit distress and/or cause an observer to infer that something is wrong. Interestingly, mothers of children higher in catastrophizing were *less* likely to utter anger words when talking about the abdominal pain than were mothers of children lower in catastrophizing. It is possible that mothers of children higher in catastrophizing are attuned to their child's heightened concern about their pain and accordingly may modify or soften their own behavior to minimize this concern.

Limitations of this study must be considered. First, the parent sample involved just mothers and not fathers. This was intentional to optimize homogeneity but, in turn, severely limits generalizability. Few studies involving fathers have been conducted, especially in the context of pediatric pain. One exception is a study by Hechler et al. (2011) in which mothers reported higher levels of catastrophizing as compared to fathers, specifically, higher levels of rumination. Mothers and fathers did not differ with respect to the magnification and helplessness components of the construct (Hechler et al., 2011). Sex differences in emotional expression are also important to consider. Research indicates that women tend in general to exhibit more expressiveness than men (Kring and Gordon, 1998), although this can differ by specific emotion (Kring, 2000). Similar in concern, our child sample comprised more girls than boys (69% versus 31%), although this is commensurate with the general population of FAP. Findings from a

meta-analysis of sex differences in emotional expression in children indicated that girls exhibit more positive and more internalizing emotions than do boys, such as sadness and anxiety, whereas boys exhibit more externalizing emotions, such as anger (Chaplin and Aldao, 2013). These differences were moderated, however, by age, with girls exhibiting more positive emotions than boys in middle childhood and adolescence, and boys exhibiting more externalizing emotions than girls as toddlers and in middle childhood, but *fewer* externalizing emotions than girls in adolescence (Chaplin and Aldao, 2013).

Another limitation of this study is that it was conducted in a laboratory setting and the conversation was semi-structured. Future research based on the observation of parent–child conversations in a more naturalistic setting such as the home would further the generalizability of findings. Finally, as noted previously, we did not assess affective state, precluding the ability to look at associations between emotional experience and expression, and expression was measured as words collapsed across the 10-minute conversation. Accordingly, we cannot examine the *sequence* of maternal and child behavior across the interaction or link these expressions to pain indices at a later time. A study of adults with chronic pain found that increases in anger expression were related to lagged increases in pain intensity and interference (Burns et al., 2015). In another study conducted by the same research group, this one including spouses and using ecological momentary assessment methods, patient-reported spousal criticism and hostility were correlated with patient pain intensity at the same time *and* 3 hours later (Burns et al., 2013). Similarly designed research in the pediatric realm is needed to elucidate patterns in child and parent behavior and child pain outcomes over time.

The preliminary and associational results of this study offer potential implications for the design of psychosocial interventions for children with chronic pain and their parents. Cognitive-behavioral therapies aimed at reducing catastrophizing cognitions may reduce negative talk about pain between children and mothers, with possible benefits for adaptive coping and adjustment. Future research is needed to better understand mechanisms by which catastrophizing may affect and be affected by parent–child interactions and how verbal behavior on the part of both parents and children may influence the development and maintenance of chronic pediatric pain.

Declaration of conflicting interests

Funding

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