Published in final edited form as:

J Pain. 2017 May ; 18(5): 597–604. doi:10.1016/j.jpain.2017.01.001.

Linguistic Indicators of Pain Catastrophizing in Patients with Chronic Musculoskeletal Pain

Doerte U. Junghaenel, Ph.D., Stefan Schneider, Ph.D., and Joan E. Broderick, Ph.D.

USC Dornsife Center for Self-Report Science, Center for Economic and Social Research, University of Southern California

Abstract

The present study examined markers of pain catastrophizing in the word use of patients with chronic pain. Patients ($n = 71$) completed the Pain Catastrophizing Scale and wrote about their life with pain. Quantitative word count analysis examined whether the essays contained linguistic indicators of catastrophizing. Bivariate correlations showed that catastrophizing was associated with greater use of first person singular pronouns, such as “I” ($r = .27, p .05$) and pronouns referencing other people ($r = .28, p .05$). Catastrophizing was further significantly associated with greater use of sadness ($r = .35, p .01$) and anger ($r = .30, p .05$) words. No significant relationships with positive emotion and cognitive process words were evident. Controlling for patients’ engagement in the writing task, gender, age, pain intensity, and neuroticism in multiple regression, the linguistic categories together uniquely explained 13.6% of the variance in catastrophizing ($p .001$). First person singular pronouns ($\beta = .24, p .05$) and words relating to sadness ($\beta = .25, p .05$) were significant, and pronouns referencing other people ($\beta = .19, p .10$) were trending. The results suggest that pain catastrophizing is associated with a “linguistic fingerprint” that can be discerned from patients’ natural word use.

Keywords

pain; pain catastrophizing; word use; linguistic; text analysis; assessment; LIWC

Introduction

Pain catastrophizing is an important psychosocial predictor of the course and experience of chronic pain (37,52). Catastrophizing is linked with poorer health outcomes (2,3,19,21,44,51), such as greater pain intensity (9,51), disability (50,54), greater

Corresponding Author: Doerte U. Junghaenel, Ph.D., USC Dornsife Center for Self-Report Science, Center for Economic and Social Research, University of Southern California, Verna & Peter Dauterive Hall, 635 Downey Way, Los Angeles, CA 90089-3332, Phone: 213-821-1780, junghaen@usc.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Part of this work was presented as a poster at an annual meeting of the Society of Behavioral Medicine.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

psychological distress (10,47,49), impaired social relations (1,2,22), and suboptimal treatment outcomes (25,52).

Several theoretical frameworks on catastrophizing and pain-related outcomes have been proposed (11,37,52). Attention and information processing models posit that catastrophizing heightens an individual's pain experience through an exaggerated cognitive focus on pain-related information, especially the negative affective aspects of pain (7,37,51). The communal coping model highlights the social-communicative aspects of catastrophizing and suggests that people catastrophize to gain support (52). Pain is not merely experienced privately but is expressed openly, for example through pain behaviors, to communicate distress (51,52,56). According to this model, catastrophizing can be ascertained through behavioral and verbal clues that can serve a communicative function. In concert, these different frameworks suggest the importance of understanding how the cognitive-emotional processes of pain catastrophizing may translate into communicative behaviors.

Among the many ways to communicate pain, a basic form is people's word use. Recent developments in computerized text analysis have shown that counting the specific types of words that people naturally use, also called quantitative word count analysis, provides important information about their psychological health and adjustment (23,24,40). Word use has been found to differentiate between formerly, never, and currently depressed students (43) and to discriminate women with and without generalized anxiety disorder (13); it has also been found to be a marker of suicidal ideation (46), adjustment to breast cancer (40), and psychological change surrounding traumatic events (5,28,35).

A benefit of quantitative word count is that it provides a naturalistic method to examine affective and cognitive aspects of people's experiences (36,55). As such, it might elucidate valuable information about a person's pain-related cognitions. Moreover, the words that people use when they talk about their pain experience may not only reflect how they think about their condition but may also influence and perpetuate their cognitive and emotional adjustment (8,12) to pain.

To date, the potential of quantitative word count for identifying "linguistic fingerprints" (36) indicative of pain catastrophizing has not been explored. In the present study, patients with persistent pain completed a standard self-report assessment of pain catastrophizing. Patients were also instructed to write an essay about their life with chronic pain. We conducted quantitative word count analysis and examined the relationships between catastrophizing and linguistic domains tapping (a) attentional focus toward self and other people, (b) positive and negative emotionality, and (c) expressions of cognitive processes.

Based on the study context, we formulated our hypotheses according to conceptual models of attention and information processing. Patients reflected on their pain experience without the presence of other people and wrote a free-form essay, similar to writing in a diary. From this perspective, we expected that catastrophizing would be associated with a heightened focus on themselves and the affective aspects of their pain experience (7,37). From a linguistic perspective, attentional allocation is revealed through use of personal pronouns (55). Accordingly, we hypothesized that an attentional focus on one's experience of pain

would express itself linguistically in greater use of first person singular pronouns, such as “I”, and fewer pronouns referencing other people. We further hypothesized that a focus on the affective aspects of pain, especially the negative ones (37), would be evident in greater use of negative and fewer positive emotion words. In addition, we examined cognitive process words. Research has shown that people who catastrophize can have a lowered understanding of their illness (low illness coherence) (14,58). We explored whether this would be reflected in fewer words denoting insight and causation. Finally, we examined whether pain catastrophizing has unique associations with linguistic markers that could not be explained by patients’ pain severity or neuroticism levels, factors that have previously been considered as important covariates of pain catastrophizing (see 37,51).

Methods

Participants

Patients were recruited from several pain specialty and physical therapy clinics for a project on patient adjustment to chronic pain (17,18). This study reports on secondary analyses with this existing dataset. Study advertisements were distributed at the recruitment facilities and patients were approached in the waiting rooms about participating in the study. Patients were eligible to enroll, if they: 1) were at least 18 years old, 2) were diagnosed with low back pain, osteoarthritis, rheumatoid arthritis, and/or fibromyalgia, 3) had regular doctor visits at the recruitment site, 4) could read, write, and speak English, and 5) had no visual impairments that would interfere with questionnaire completion. Out of the 99 patients who participated in the project, 75 provided a writing sample about their life with chronic pain. This essay was optional and was not a mandatory aspect of the project. Reasons for not completing this assessment included (a) patients only agreeing to complete the questionnaire battery at study enrollment due to time constraints ($n = 16$), (b) refusal to engage in the writing due to unknown reasons ($n = 5$), and (c) physical inability to complete the writing due to broken limbs ($n = 3$).

Procedure

The study was reviewed and approved by all institutions involved. Written consent was obtained from patients prior to engaging in study procedures. Approximately 10–14 days after study enrollment, patients were mailed a questionnaire package to their home along with a letter from the research office. The letter instructed the patient to complete the questionnaire within 1–2 days of receipt and mail it back to the research office in the enclosed pre-addressed stamped envelope. Patients were called approximately 2 days later to confirm that they received the package and to prompt questionnaire completion. On the day of their next routine doctor visit (4–6 weeks after enrollment into the study), patients met with the research staff in a private area at the doctor’s office and were asked to write an essay about their life with chronic pain. Patients were also given the option of completing the writing sample at home in the event that there was insufficient time at the doctor’s office after the medical visit or the visit got rescheduled (four patients completed the writing sample at home).

The writing instructions were modeled after those used previously in written emotional disclosure studies (45) and asked patients to write about their deepest thoughts and feelings about their life with chronic pain. Due to the emotional nature of the writing, a private area to write was provided by the research staff. The written instructions encouraged patients to explore their deepest thoughts and feelings and the changes that they experienced after diagnosis with chronic pain, during treatment, and in the present. Patients were also encouraged to tie their thoughts and feelings about their experiences with chronic pain to other parts of their life that is, their childhood, people they love, who they are, or who they want to be. Patients were told not to worry about grammar, spelling, or sentence structure or about erasing or crossing things out. They were asked to spend about 20 minutes privately on the writing task.

Measures

Patients provided demographic information including their age, gender, race, ethnicity, education, marital status, employment, and disability status. They also completed the following self-report assessment instruments that were mailed to them in the questionnaire package.

Pain Catastrophizing—The Pain Catastrophizing Scale (PCS) consists of 13 self-report items that assess rumination, magnification, and feelings of helplessness in response to pain (53). The PCS has been shown to have good internal consistency (Cronbach alpha = .91), which was replicated in the present study (Cronbach alpha total = .94). The temporal stability of the PCS has been reported ($r = .70 - .78$) indicating good stability across a six-week period of time (53).

Neuroticism and Pain Severity

Neuroticism: Patients completed the 49-item neuroticism scale of the Revised *NEO* Personality Inventory (NEO-PI-R). Reliability and validity are well-established (6). The neuroticism scale has demonstrated adequate temporal stability over a three-month period ($r = .83$) as well as high internal consistency (Cronbach's alpha = .92) (6). The internal consistency in the present study was .93.

Pain Severity: The Multidimensional Pain Inventory (MPI) is one of the most widely-used self-report instruments to assess the multifaceted nature of chronic pain (20). The 61-item patient version (version 2) assesses key variables that are associated with the chronic pain experience. It has demonstrated adequate validity and reliability in numerous chronic pain conditions (57). The MPI subscales have demonstrated good temporal stability ($r = .62 - .91$) and internal consistency (Cronbach's alpha = .70 to .90) (20,57). For this study, the 3-item MPI pain severity subscale was used. The internal consistency in the present study was .87.

Quantitative Word Count Program

Linguistic Inquiry and Word Count (LIWC): Patients' essays were analyzed via the LIWC2007 program (33). The program is a widely used text analysis module (36,55). It processes text word-by-word and yields a percentage of words that are in a set of distinct

linguistic and psychological categories (i.e., the number of specific types of words is divided by the total number of words in a text sample). The dimensions are hierarchically organized and consist of standard language dimensions (e.g., articles, pronouns), affect-related words (i.e., positive and negative emotion words), psychological processes (e.g., cognitive mechanisms) as well as traditional content dimensions (e.g., work, leisure).

The present study examined eight specific linguistic categories from the LIWC: In the personal pronoun category, we focused on the use of (1) first person singular pronouns (e.g., “I”, mine, me) and (2) pronouns referencing other people; in the affect category, we examined words relating to negative emotions, specifically the LIWC subcategories (3) anxiety, (4) anger, and (5) sadness, and words pertaining to (6) positive emotions (there are no subcategories for positive emotion words in the LIWC2007); in the category of cognitive mechanisms, we focused on words relating to (7) causation and (8) insight.

Analytic Strategy

All data were double-entered and computer verified. Initial inspection of the linguistic categories showed that their distributions were positively skewed. In order to normalize the data, we applied arcsine transformations, an approach that is consistent with previous research (41,42). The transformed values for the linguistic categories were used in all analyses. In the first step, bivariate correlations between the linguistic categories and patients’ pain catastrophizing scores were examined. Secondly, a stepwise multiple regression analysis was conducted (F -entry criterion: .10 and F -removal criterion: .20) to examine which of the linguistic categories made the strongest contribution in the prediction of pain catastrophizing. Multicollinearity statistics for the linguistic predictor variables were examined prior to the regression analyses; all tolerance values were close to 1.0, (range = .89 to .99), suggesting no problems of multicollinearity. As a result, all linguistic categories were considered as potential predictors of pain catastrophizing in the multiple regression. In the third step, we were interested in determining whether the linguistic categories contributed to pain catastrophizing when controlling for pain intensity (37,51) and neuroticism (15,26), factors that have previously been considered as important covariates due to their association with pain catastrophizing (37,51,52). By controlling for these variables, we examine the specificity hypothesis that people’s word use is characteristic of how much they catastrophize at any given level of pain severity, and regardless of their neuroticism. To do this, we conducted another regression analyses that first included a hierarchical portion where neuroticism and pain severity were entered in block 1. We also included patients’ gender, age, and overall engagement or willingness to write about their pain experience, as indicated by the total number of words written, as a covariate in block 1. We then entered the linguistic categories in a stepwise fashion in block 2 to determine which ones had the strongest statistical association with pain catastrophizing.

Results

Participants

Patients who completed the writing task ($n = 75$) did not differ significantly from those patients who did not provide an essay ($n = 24$) on basic demographic, medical, general

health status characteristics, and pain catastrophizing. Out of the 75 participants who provided an essay, two outlier writing samples were excluded because they did not provide enough text for meaningful linguistic analysis (i.e., they wrote fewer than thirty words), and two patients could not be included in the analyses because they had missing scores on the PCS. Therefore, the final analysis sample comprised 71 patients.

Table 1 provides an overview of the participant sample. The mean age of the sample was 55.4 years ($SD = 10.4$). Thirty-eight (54%) patients were female and forty-three (61%) were married. Approximately 52% of the patients had completed 1–4 years of college education. Patients identified their primary pain complaint as low back pain (82%), osteoarthritis (10%), rheumatoid arthritis (4%), and fibromyalgia (4%). The mean word count of the writing samples was 273.8 words ($SD = 173.4$). Patients' mean PCS score was 23.5 ($SD = 11.8$), a level comparable to that reported previously for patients with musculoskeletal pain (53).

Correlations between Linguistic Categories and Pain Catastrophizing Scores

Table 2 shows the bivariate correlations between the linguistic categories and pain catastrophizing scores along with descriptive statistics (means and SDs) of the word use categories. The means of the linguistic categories found in patients' essays were comparable to those reported across twenty studies that asked participants to write about their emotions and thoughts about personally important experiences (34). Pain catastrophizing was significantly associated with greater use of first person singular pronouns ($r = .27, p = .03$) and with more pronouns referencing other people ($r = .28, p = .02$). For affect-related words, pain catastrophizing was significantly associated with greater use of negative emotion words indicating sadness ($r = .35, p = .003$) and anger ($r = .30, p = .01$); a non-significant positive relationship was observed for words indicating anxiety. There was a trend for a negative relationship between catastrophizing and words pertaining to positive emotions ($r = -.20, p = .10$). No significant relationships between psychological process words – insight and causation – and pain catastrophizing were evident.

Multiple Regression Analysis of Linguistic Parameters predicting Pain Catastrophizing

The eight linguistic categories were then entered as predictors in a stepwise multiple regression analysis with pain catastrophizing as the dependent variable. The overall regression model was highly significant ($F = 6.80, p = .001$) and the linguistic variables jointly explained 29.2% of the variance in pain catastrophizing. Four linguistic variables made significant or trending contributions in the prediction of pain catastrophizing: Use of pronouns referencing other people ($\beta = .22, p = .04$), words relating to anger ($\beta = .24, p = .03$) and words relating to sadness ($\beta = .31, p = .004$). The use of first person singular pronouns ($\beta = .20, p = .07$) showed a trend.

Multiple Regression Analysis controlling for Pain Severity, Neuroticism, Essay Length, Gender, and Age

In line with prior research (2,4,46), we found significant associations between catastrophizing and neuroticism ($r = .41, p < .001$) and between catastrophizing and pain severity ($r = .33, p = .005$). For the linguistic categories, pain severity and neuroticism

showed small and non-significant associations with first person singular pronouns ($r = .13$ and $r = -.06$, respectively), pronouns referencing other people ($r = .13$ and $r = .07$, respectively), positive emotion words ($r = .08$ and $r = -.18$, respectively), words relating to anger ($r = .17$ and $r = .20$, respectively), anxiety ($r = -.19$ and $r = .00$, respectively), and sadness ($r = .15$ and $r = .11$, respectively) as well as words relating to insight ($r = .02$ and $r = .09$, respectively) and causation ($r = .08$ and $r = .00$, respectively).

We re-ran the multiple regression analysis controlling for pain severity, neuroticism, length of the writing samples, patient gender, and age. The results of the regression analysis are shown in Table 3. In total, the control and linguistic variables explained 40.0% of the variance in pain catastrophizing. After accounting for the effects of the control variables in Block 1 (26.4% of the variance, $F = 4.67$, $p < .01$), the linguistic categories uniquely explained an additional 13.6% of the variance ($F = 5.16$, $p < .001$), with use of first person singular pronouns and words related to sadness being significant predictors ($ps = .03$), and references to other people being a trending predictor ($p = .08$) of catastrophizing in the final model.

Discussion

The goal of the present study was to examine linguistic patterns associated with pain catastrophizing in patients with persistent musculoskeletal pain. We formulated our hypotheses based on an attention and information processing framework for pain catastrophizing (37,51). Based on this model, we expected that patients who catastrophize would exhibit a heightened focus on the self and the negative emotional aspects of their pain experience when writing about their life with chronic pain.

The results of our bivariate correlational and multiple regression analyses largely supported these hypotheses. High pain catastrophizing was significantly associated with greater use of first person singular pronouns, suggesting that patients' heightened attention towards themselves expressed itself linguistically through increased self-references (55). Our results join other studies that have examined the relationship between constructs that share related features with catastrophizing and personal pronoun use. For example, use of first person singular pronouns has been found to be a marker of depression and suicidal ideation (43,46). Rude and colleagues (43) showed that the use of this pronoun differentiated between currently depressed, formerly depressed, and never depressed college students, with the former group expressing the greatest percentage of references to the self. Our result extends prior work by demonstrating the salience of this pronoun as a marker for pain-specific psychological distress in patients with chronic pain.

An unexpected finding was the association between catastrophizing and the use of pronouns referencing other people. We expected that patients would make more references to themselves (and this was confirmed with the use of first person singular pronouns) and fewer references to other people. In contrast, high pain catastrophizing was associated with more references to the self as well as a greater number of references to other people. Although we did not expect this finding based on conceptual models of attention and information

processing, this result suggests some support for a communal coping perspective on pain catastrophizing.

According to the communal coping model, patients who catastrophize place special emphasis on garnering support and assistance from their social network (48,51,52). Other people are, therefore, an integral part of patients' pain experience. Supporting evidence has demonstrated that expressions of pain severity and displays of pain behavior are particularly heightened in the presence of other people (52). Our result suggests that references to other people were evident in patients' written accounts of their experience of living with chronic pain when catastrophizing was high. It is important to note, however, that the results of the quantitative word count analysis do not enable the detection of the specific context, in which the words were used. For example, it is not clear whether patients referred to other people in a positive (e.g., she/he helps me) or unfavorable manner (e.g., they do not understand my pain).

As we expected, high pain catastrophizing was associated with greater use of negative emotion words (e.g. angry, sad). These results are in line with theoretical conceptualizations of heightened attention toward negatively-valenced aspects of pain (37). Our writing instructions allowed patients to choose which pain-related emotions and thoughts they wanted to write about. It appears that patients' catastrophizing was associated with greater emphasis on the negative aspects of their pain experience. Specifically, we found significant associations between catastrophizing and words indicating anger (e.g. annoyed), and sadness (e.g. crying); with the magnitude of correlations indicating medium effect sizes according to Cohen (4). Prior studies using standard self-report affect measures of these constructs have confirmed similar relationships (51,53) and our findings extend this research by demonstrating that patients who catastrophize convey some of this negative affect in their natural language.

From a linguistic perspective, use of positive and negative emotion words has also been found to be a measure of the degree of immersion or engagement in a personally relevant experience (55). For example, Holmes and colleagues (16) found that higher use of affect-related words in women's description of partner violence reflected greater immersion in the traumatic event, which predicted heightened experience of physical pain. With regard to our sample, the increased expression of negative emotionality in people's essays might, therefore, reflect a pronounced affective involvement by patients who catastrophize when schemata of the pain experience are activated – a finding that is consistent with attention and information processing models (37) and relates to research on self-pain enmeshment (31).

Based on related research on illness coherence, we explored whether patients who catastrophize would express fewer words pertaining to insight (e.g. think, know, consider) and causation (e.g. because, effect, hence) (14,58). This exploratory hypothesis was not supported in that words relating to cognitive processes showed no significant relationship with catastrophizing. Prior research on language use has found that changes in the use of cognitive process words have important associations with positive adaptation to stress and medical illness (32,36). Specifically, this previous work showed that it was an *increase* in the use of insight and causation words over the course of several therapeutic writing sessions

that was associated with positive adjustment. In the present study, patients engaged in a single writing session so we could not examine changes in insight and causation words. Our results suggest that patients' base rate use of insight and causation words is not associated with their tendency to catastrophize.

Finally, the results of our multiple regression analyses showed that three linguistic categories predicted a significant and moderate portion of the variance in self-reported pain catastrophizing (i.e., use of first person singular pronouns and words relating to sadness made significant contributions, and the contribution of pronouns referencing other people was trending), even after controlling for patients' overall engagement in the writing task, neuroticism, and pain intensity levels. This finding suggests that a person's linguistic style contains unique information about a person's tendency to catastrophize that is not simply a reflection of neuroticism or levels of pain severity.

The present study has several limitations. First, our sample size was small and our results should be considered preliminary requiring further replication with larger samples. Second, our sample was mostly Caucasian; future research should examine whether our results generalize to samples that are more diverse, racially and ethnically. Third, our writing assignment was done as part of a research project, and most patients completed their essay in the doctor's office. This setting may have introduced a self-presentational bias that may not be evident had we collected language samples in patients' natural environment. In addition, our writing instructions guided patients to focus on their pain and pain experience. Future research may benefit from exploring different instructional sets (for example, writing about one's feelings and emotions about life, in general, without a specific focus on pain-related experiences) and from exploring more ecologically valid linguistic sampling methodologies, such as the use of the Electronically Activated Recorder (EAR), which samples snippets of people's word use as they go about their daily lives (29). For example, recent research has demonstrated that naturalistically-sampled word use through the EAR was associated with emotional support and depressive symptoms in patients with rheumatoid arthritis and breast cancer (38,39). Fourth, the results from the quantitative word count analyses cannot provide insight into the content of patients' essays. In other words, it is not clear how different types of words were connected and how they were used within the context of a sentence or broader theme, and one cannot infer the meaning of the linguistic categories in a particular sentence. Nevertheless, the fact that a relatively "simple" word count strategy reveals pronounced associations with catastrophizing is encouraging evidence for the usefulness of the approach.

In sum, the results of the present study provide initial supportive evidence that pain catastrophizing is reflected in patients' natural word use. Our findings extend prior research that has shown that attention to people's everyday language can be helpful for tracking their psychological health status (5,32,36). Due to its non-intrusive approach that gleans information from people's spontaneous utterances, linguistic analysis is considered an "observational window" that can augment standard self-report and circumvent shared method variance (38,40). It may also be useful as an alternative assessment method for the validation of patient-reported outcomes (36,55). Future work might explore studying linguistic differences in the word use of healthy participants compared to those with chronic

pain or other medical conditions. Future research would also benefit from examining the relationship between word use and other pain-related outcomes (e.g., social support, life control) and whether our results translate into patients' spoken communication during daily interactions with their social network and during medical visits, for example through the use of the EAR (27,29,30). The patients in this study wrote about their life with chronic pain in private without being in the presence of other people. It is possible that the communication about their life with chronic pain might differ in a direct conversation with their healthcare provider or family member. Future work on language use and catastrophizing in these types of contexts could prove useful for testing predictions specific to the communal coping model. Pending replication, attention to these linguistic indicators might then prove useful for identifying important aspects of the cognitive and communicative mechanisms of pain catastrophizing that can then be target for modification during psychological treatment in patients with chronic pain.

Acknowledgments

We thank our patients who participated in this study for sharing their story with us. We further thank the reviewers for their valuable comments on the manuscript.

Disclosures

This work was supported in part by a grant from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (R01 AR066200).

References

1. Buenaver LF, Edwards RR, Haythornthwaite JA. Pain-related catastrophizing and perceived social responses: Inter-relationships in the context of chronic pain. *Pain*. 2007; 127:234–42. [PubMed: 17011706]
2. Cano A. Pain catastrophizing and social support in married individuals with chronic pain: the moderating role of pain duration. *Pain*. 2004; 110:656–64. [PubMed: 15288406]
3. Cano A, Leong L, Heller JB, Lutz JR. Perceived entitlement to pain-related support and pain catastrophizing: associations with perceived and observed support. *Pain*. 2009; 147:249–54. [PubMed: 19828251]
4. Cohen J. A power primer. *Psychological bulletin*. 1992; 112:155–9. [PubMed: 19565683]
5. Cohn MA, Mehl MR, Pennebaker JW. Linguistic markers of psychological change surrounding September 11, 2001. *Psychological science*. 2004; 15:687–93. [PubMed: 15447640]
6. Costa, PT., McCrae, RR. NEO PI-R professional manual. Odessa, FL: Psychological Assessment Resources, Inc; 1992.
7. Eccleston C, Crombez G. Pain demands attention: a cognitive-affective model of the interruptive function of pain. *Psychological bulletin*. 1999; 125:356–66. [PubMed: 10349356]
8. Eccleston C, Fisher E, Craig L, Duggan GB, Rosser BA, Keogh E. Psychological therapies (Internet-delivered) for the management of chronic pain in adults. *The Cochrane database of systematic reviews*. 2014;CD010152. [PubMed: 24574082]
9. Edwards RR, Bingham CO 3rd, Bathon J, Haythornthwaite JA. Catastrophizing and pain in arthritis, fibromyalgia, and other rheumatic diseases. *Arthritis and rheumatism*. 2006; 55:325–32. [PubMed: 16583384]
10. Edwards RR, Smith MT, Kudel I, Haythornthwaite J. Pain-related catastrophizing as a risk factor for suicidal ideation in chronic pain. *Pain*. 2006; 126:272–9. [PubMed: 16926068]
11. Flink IL, Boersma K, Linton SJ. Pain catastrophizing as repetitive negative thinking: a development of the conceptualization. *Cognitive behaviour therapy*. 2013; 42:215–23. [PubMed: 23978106]

12. Geenen R, Newman S, Bossema ER, Vrieseckolk JE, Boelen PA. Psychological interventions for patients with rheumatic diseases and anxiety or depression. Best practice & research Clinical rheumatology. 2012; 26:305–19. [PubMed: 22867928]
13. Geronimi EMC, Woodruff-Borden J. The language of worry: Examining linguistic elements of worry models. Cognition Emotion. 2015; 29:311–8. [PubMed: 24839945]
14. Gillanders DT, Ferreira NB, Bose S, Esrich T. The relationship between acceptance, catastrophizing and illness representations in chronic pain. European journal of pain. 2013; 17:893–902. [PubMed: 23169693]
15. Goubert L, Crombez G, Van Damme S. The role of neuroticism, pain catastrophizing and pain-related fear in vigilance to pain: a structural equations approach. Pain. 2004; 107:234–41. [PubMed: 14736586]
16. Holmes D, Alpers GW, Ismailji T, Classen C, Wales T, Cheasty V, Miller A, Koopman C. Cognitive and emotional processing in narratives of women abused by intimate partners. Violence against Wom. 2007; 13:1192–205.
17. Junghaenel DU, Broderick JE. Validation of the MPI patient profiles by partners and healthcare providers. Pain. 2009; 144:130–8. [PubMed: 19410367]
18. Junghaenel DU, Keefe FJ, Broderick JE. Multi-modal examination of psychological and interpersonal distinctions among MPI coping clusters: a preliminary study. The journal of pain : official journal of the American Pain Society. 2010; 11:87–96. [PubMed: 19783221]
19. Keefe FJ, Lefebvre JC, Egert JR, Affleck G, Sullivan MJ, Caldwell DS. The relationship of gender to pain, pain behavior, and disability in osteoarthritis patients: the role of catastrophizing. Pain. 2000; 87:325–34. [PubMed: 10963912]
20. Kerns RD, Turk DC, Rudy TE. The West Haven-Yale Multidimensional Pain Inventory (WHYMPI). Pain. 1985; 23:345–56. [PubMed: 4088697]
21. Kovacs FM, Seco J, Royuela A, Corcoll-Reixach J, Pena-Arrebola A, Spanish Back Pain Research N. The prognostic value of catastrophizing for predicting the clinical evolution of low back pain patients: a study in routine clinical practice within the Spanish National Health Service. Spine J. 2012; 12:545–55. [PubMed: 22819318]
22. Leonard MT, Cano A. Pain affects spouses too: personal experience with pain and catastrophizing as correlates of spouse distress. Pain. 2006; 126:139–46. [PubMed: 16860476]
23. Liehr P, Marcus MT, Carroll D, Granmayeh LK, Cron SG, Pennebaker JW. Linguistic analysis to assess the effect of a mindfulness intervention on self-change for adults in substance use recovery. Substance abuse. 2010; 31:79–85. [PubMed: 20408059]
24. Lyons EJ, Mehl MR, Pennebaker JW. Pro-anorexics and recovering anorexics differ in their linguistic Internet self-presentation. J Psychosom Res. 2006; 60:253–6. [PubMed: 16516656]
25. Mankovsky T, Lynch M, Clark A, Sawynok J, Sullivan MJ. Pain catastrophizing predicts poor response to topical analgesics in patients with neuropathic pain. Pain research & management : the journal of the Canadian Pain Society = journal de la societe canadienne pour le traitement de la douleur. 2012; 17:10–4.
26. Martin MY, Bradley LA, Alexander RW, Alarcon GS, Triana-Alexander M, Aaron LA, Alberts KR. Coping strategies predict disability in patients with primary fibromyalgia. Pain. 1996; 68:45–53. [PubMed: 9251997]
27. Mehl MR, Gosling SD, Pennebaker JW. Personality in its natural habitat: manifestations and implicit folk theories of personality in daily life. Journal of personality and social psychology. 2006; 90:862–77. [PubMed: 16737378]
28. Mehl MR, Pennebaker JW. The social dynamics of a cultural upheaval: Social interactions surrounding September 11, 2001. Psychological science. 2003; 14:579–85. [PubMed: 14629689]
29. Mehl MR, Pennebaker JW, Crow DM, Dabbs J, Price JH. The Electronically Activated Recorder (EAR): A device for sampling naturalistic daily activities and conversations. Behav Res Meth Ins C. 2001; 33:517–23.
30. Mehl MR, Robbins ML, Deters FG. Naturalistic observation of health-relevant social processes: the electronically activated recorder methodology in psychosomatics. Psychosom Med. 2012; 74:410–7. [PubMed: 22582338]

31. Morley S, Davies C, Barton S. Possible selves in chronic pain: self-pain enmeshment, adjustment and acceptance. *Pain*. 2005; 115:84–94. [PubMed: 15836972]
32. Pennebaker JW. Putting stress into words: health, linguistic, and therapeutic implications. *Behaviour research and therapy*. 1993; 31:539–48. [PubMed: 8347112]
33. Pennebaker, JW., Chung, CK., Ireland, M., Gonzales, A., Booth, RJ. The development and psychometric properties of LIWC2007. Austin, TX: LIWC.net; 2007.
34. Pennebaker, JW., Francis, ME., Booth, RJ. *Linguistic Inquiry and Word Count – LIWC2001*. Mahwah, NJ: Erlbaum Publishers; 2001.
35. Pennebaker JW, Mayne TJ, Francis ME. Linguistic predictors of adaptive bereavement. *Journal of personality and social psychology*. 1997; 72:863–71. [PubMed: 9108699]
36. Pennebaker JW, Mehl MR, Niederhoffer KG. Psychological aspects of natural language use: Our words, our selves. *Annual review of psychology*. 2003; 54:547–77.
37. Quartana PJ, Campbell CM, Edwards RR. Pain catastrophizing: a critical review. *Expert Rev Neurother*. 2009; 9:745–58. [PubMed: 19402782]
38. Robbins ML, Focella ES, Kastle S, Lopez AM, Weihs KL, Mehl MR. Naturalistically observed swearing, emotional support, and depressive symptoms in women coping with illness. *Health Psychol*. 2011; 30:789–92. [PubMed: 21574707]
39. Robbins ML, Mehl MR, Holleran SE, Kastle S. Naturalistically observed sighing and depression in rheumatoid arthritis patients: a preliminary study. *Health Psychol*. 2011; 30:129–33. [PubMed: 21299301]
40. Robbins ML, Mehl MR, Smith HL, Weihs KL. Linguistic indicators of patient, couple, and family adjustment following breast cancer. *Psycho-Oncology*. 2013; 22:1501–8. [PubMed: 22887054]
41. Rohrbaugh MJ, Mehl MR, Shoham V, Reilly ES, Ewy GA. Prognostic significance of spouse we talk in couples coping with heart failure. *Journal of consulting and clinical psychology*. 2008; 76:781–9. [PubMed: 18837595]
42. Rohrbaugh MJ, Shoham V, Skoyen JA, Jensen M, Mehl MR. We-talk, communal coping, and cessation success in a couple-focused intervention for health-compromised smokers. *Family process*. 2012; 51:107–21. [PubMed: 22428714]
43. Rude SS, Gortner EM, Pennebaker JW. Language use of depressed and depression-vulnerable college students. *Cognition Emotion*. 2004; 18:1121–33.
44. Severeijns R, Vlaeyen JW, van den Hout MA, Picavet HS. Pain catastrophizing is associated with health indices in musculoskeletal pain: a cross-sectional study in the Dutch community. *Health Psychol*. 2004; 23:49–57. [PubMed: 14756603]
45. Stanton AL, Danoff-Burg S, Sworowski LA, Collins CA, Branstetter AD, Rodriguez-Hanley A, Kirk SB, Austenfeld JL. Randomized, controlled trial of written emotional expression and benefit finding in breast cancer patients. *J Clin Oncol*. 2002; 20:4160–8. [PubMed: 12377959]
46. Stirman SW, Pennebaker JW. Word use in the poetry of suicidal and nonsuicidal poets. *Psychosom Med*. 2001; 63:517–22. [PubMed: 11485104]
47. Sullivan MJ, D'Eon JL. Relation between catastrophizing and depression in chronic pain patients. *Journal of abnormal psychology*. 1990; 99:260–3. [PubMed: 2145334]
48. Sullivan MJ, Martel MO, Tripp D, Savard A, Crombez G. The relation between catastrophizing and the communication of pain experience. *Pain*. 2006; 122:282–8. [PubMed: 16545907]
49. Sullivan MJ, Rodgers WM, Kirsch I. Catastrophizing, depression and expectancies for pain and emotional distress. *Pain*. 2001; 91:147–54. [PubMed: 11240087]
50. Sullivan MJ, Stanish W, Waite H, Sullivan M, Tripp DA. Catastrophizing, pain, and disability in patients with soft-tissue injuries. *Pain*. 1998; 77:253–60. [PubMed: 9808350]
51. Sullivan MJ, Thorn B, Haythornthwaite JA, Keefe F, Martin M, Bradley LA, Lefebvre JC. Theoretical perspectives on the relation between catastrophizing and pain. *The Clinical journal of pain*. 2001; 17:52–64. [PubMed: 11289089]
52. Sullivan MJL. The Communal Coping Model of Pain Catastrophising: Clinical and Research Implications. *Can Psychol*. 2012; 53:32–41.
53. Sullivan MJL, Bishop SR, Pivik J. The Pain Catastrophizing Scale: Development and validation. *Psychological assessment*. 1995; 7:524–32.

54. Sullivan MJL, Stanish WD. Psychologically based occupational rehabilitation: The pain-disability prevention program. *Clinical Journal of Pain*. 2003; 19:97–104. [PubMed: 12616179]
55. Tausczik YR, Pennebaker JW. The Psychological Meaning of Words: LIWC and Computerized Text Analysis Methods. *J Lang Soc Psychol*. 2010; 29:24–54.
56. Thorn BE, Ward LC, Sullivan MJ, Boothby JL. Communal coping model of catastrophizing: conceptual model building. *Pain*. 2003; 106:1–2. [PubMed: 14581103]
57. Turk DC. The potential of treatment matching for subgroups of patients with chronic pain: lumping versus splitting. *The Clinical journal of pain*. 2005; 21:44–55. discussion 69–72. [PubMed: 15599131]
58. van Wilgen CP, van Ittersum MW, Kaptein AA, van Wijhe M. Illness perceptions in patients with fibromyalgia and their relationship to quality of life and catastrophizing. *Arthritis and rheumatism*. 2008; 58:3618–26. [PubMed: 18975315]

Perspective

Quantitative word count analysis examined whether pain catastrophizing is reflected in patients' written essays about living with pain. Catastrophizing was associated with more first person singular pronouns, more pronouns referencing other people, and more expressions of sadness and anger. The results can help understand how catastrophizing translates into communicative behaviors.

Highlights

- Linguistic indicators of pain catastrophizing in patients with chronic pain were examined.
- Computerized quantitative word count analysis of patients' essays about their life with chronic pain was conducted.
- Pain catastrophizing was associated with several distinct linguistic markers.

Table 1

Demographic Characteristics of the Patient Sample (n = 71)

Demographics	Patient Sample
Age (M, <i>SD</i>)	55.4 (10.4)
Gender (%)	
Female	54%
Marital Status (%)	
Married	61%
Education (%) ^a	
High School Graduate	38%
1–4 Years of College	52%
Graduate Education	10%
Race (%) ^b	
White	97%
Employment (%) ^c	
Employed	33%
Disability Status (%) ^b	
Part-time/Full-time	48%
Primary pain diagnosis (%)	
Low back pain	82%
Osteoarthritis	10%
Rheumatoid arthritis	4%
Fibromyalgia	4%
Years since pain symptoms began (M, <i>SD</i>) ^c	9.0 (8.7)

Note:

^a
n = 69;^b
n = 64;^c
n = 70;

Table 2

Means, Standard Deviations, and Bivariate Correlations between Linguistic Categories and Pain Catastrophizing (n = 71)

Linguistic Categories	Correlation with Pain Catastrophizing	Mean	SD
Personal Pronouns			
First person singular (e.g., "I", me, my)	.27 [*]	10.8	3.1
Other people (e.g., she/he, they)	.28 [*]	1.6	3.1
Affect			
Positive emotions (e.g., happy, nice) ^a	-.20 [^]	3.1	1.7
Anxiety (e.g., scared, fearful)	.18	.73	1.1
Anger (e.g., angry, mad)	.30 [*]	.55	.66
Sadness (e.g., sad, cry)	.35 ^{**}	.81	.78
Cognitive Processes			
Insight (e.g., think, know)	.01	3.6	4.2
Causation (e.g., because, effect)	-.09	2.2	1.4

Note:

^aThe LIWC2007 does not contain subcategories for positive emotions.

p .001;

**
p .01;

*
p .05;

[^]p .10; correlations are based on arcsine transformed linguistic categories; descriptive values (mean, SD) are based on untransformed values of the linguistic categories representing the percentage of words in each category.

Table 3

Multiple Regression Analysis of Linguistic Parameters predicting Pain Catastrophizing (n = 71)

Criterion: Pain Catastrophizing			
	β	p	R ²
Step 1			
Control Variables			26.4% **
<i>Pain Severity</i>	.14	.191	
<i>Neuroticism</i>	.37	.001	
<i>Essay Length</i>	.09	.496	
<i>Patient Gender</i>	.09	.418	
<i>Patient Age</i>	.03	.821	
Step 2			
Linguistic Predictors			13.6% ***
<i>First Person Singular Pronouns</i>	.24	.026	
<i>Other People Pronouns</i>	.19	.078	
<i>Sadness</i>	.25	.034	
Total R²			40.0% ***

Note:

p < .001;

**
p < .01; Results are based on arcsine transformed linguistic predictors. We also examined whether the results would remain the same when the untransformed linguistic variables were used. The pattern of significant results was the same with the exception of the effect of pronouns referencing other people, which was no longer trending.