

Pain Catastrophizing Predicts Pain Intensity, Disability, and Psychological Distress Independent of the Level of Physical Impairment

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Abstract:

Objective: The aim of the current study was to examine the relation between catastrophizing and pain intensity, pain-related disability, and psychological distress in a group of patients with chronic pain, controlling for the level of physical impairment. Furthermore, it was examined whether these relations are the same for three subgroups of chronic pain patients: those with chronic low back pain, those with chronic musculoskeletal pain other than low back pain, and those with miscellaneous chronic pain complaints, low back pain and musculoskeletal pain excluded.

Design: Correlational, cross-sectional.

Patients and Setting: Participants in this study were 211 consecutive referrals presenting to a university hospital pain management and research center, all of whom had a chronic pain problem.

Results: Overall, chronic pain patients who catastrophize reported more pain intensity, felt more disabled by their pain problem, and experienced more psychological distress. Regression analyses revealed that catastrophizing was a potent predictor of pain intensity, disability, and psychological distress, even when controlled for physical impairment. No fundamental differences between the three subgroups were found in this respect. Finally, it was demonstrated that there was no relation between physical impairment and catastrophizing.

Conclusions: It was concluded that for different subgroups of chronic pain patients, catastrophizing plays a crucial role in the chronic pain experience, significantly contributing to the variance of pain intensity, pain-related disability, and psychological distress. These relations are not confounded by the level of physical impairment. Some clinical implications of the results are discussed. Finally, the authors concluded that these results support the validity of a cognitive-behavioral conceptualization of chronic pain-related disability.

Key Words: Back pain—Catastrophizing—Disability—Pain intensity—Psychological distress—Physical impairment.

Recently, there has been a growing focus on the role of psychological factors in chronic pain research. From this

research, some consistent findings are emerging. First, in chronic pain, pathophysiologic processes do not adequately explain the levels of pain and disability^{§1} that

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[§]Disability is defined as any restriction or lack of ability to perform an activity in the manner or within the range considered normal for a human being that results from an impairment (World Health Organization definition).

chronic pain patients report.²⁻⁷ In other words, there is no strong relation between objective physical impairment^{||} and pain and disability. Second, catastrophizing, which is defined as “overappraisal” of the negative aspects/consequences of an experience,^{8,9} appears to play an important role in the chronic pain experience¹⁰⁻¹⁶ and has been consistently linked to, among others, pain intensity, pain-related disability, and psychological distress.^{13,17-26} Third, there are some prospective studies that suggest that catastrophizing is a precursor of pain problems rather than a consequence.²⁷⁻³⁰ These findings corroborate a cognitive-behavioral conceptualization of chronic pain, elaborated in a model by Vlaeyen et al.,³ which assumes that catastrophizing in relation to pain promotes fear of movement/(re)injury. The latter, in turn, leads to avoidance behavior, disuse, disability, and depression.

Nevertheless, some questions remain to be resolved. Although there appears to be only a moderate relation between physical impairment and pain intensity and disability, there are at least two studies that suggest a significant relation between catastrophizing and physical impairment.^{13,14} Main and Waddell¹³ found a significant relation ($r = 0.32, p < 0.001$) between objective physical impairment and catastrophizing, as measured by the Coping Strategies Questionnaire³¹ subscale. Reesor and Craig¹⁴ found that patients with chronic low back pain (CLBP) who displayed more nonorganic signs and symptoms[¶] (termed “incongruent” patients) had greater physical impairment and disability and catastrophized more about their pain than so-called “congruent” CLBP patients. In line with this, it cannot be ruled out that physical impairment is a confounding variable, however remote that possibility might be. In contrast, if the cognitive-behavioral model of catastrophizing and fear of movement/(re)injury³ is valid, it is to be expected that the relation between catastrophizing and pain intensity, pain-related disability, and psychological distress holds, irrespective of the level of physical impairment. This has yet to be demonstrated in research.

The aim then of the current study was to investigate the relation between catastrophizing and pain intensity, pain-related disability, and psychological distress in a group of patients with chronic pain. We hypothesized that overall, chronic pain patients who catastrophize experience more pain intensity, feel more disabled by their

pain problem, and experience more psychological distress. To rule out the possibility that physical impairment is a confounding variable, we will analyze it as a covariate. For exploratory reasons, we will also examine whether these relations apply to different subgroups of chronic pain patients (i.e., whether there is an interaction effect between catastrophizing and group membership). Confirming the aforementioned hypotheses across homogeneous subgroups with different medical diagnoses would signify additional support for the important role of catastrophizing in the chronic pain experience. The following subgroups are distinguished: a group of CLBP patients, a group of patients with chronic musculoskeletal pain other than low back pain (e.g., chronic neck pain or shoulder pain), and a group of patients with miscellaneous pain complaints, low back pain and other musculoskeletal pain excluded (e.g., headache, abdominal pain, facial pain).

METHODS

Participants and procedure

Participants in this study were 211 consecutive referrals presenting to a university hospital pain management and research center. All participants had a chronic pain problem (i.e., pain duration of at least 6 months). The sample consisted of 75 men and 136 women with a mean age of 48 years ($SD = 14.3$). Three rather homogeneous subgroups of chronic pain patients could be distinguished, taking into account the fact that the subgroups had to be large enough to permit statistical analyses (i.e., regression analyses). Of the total sample, 54 participants (25.6%) suffered from CLBP, 107 (50.7%) suffered from chronic musculoskeletal pain other than low back, and 50 participants (23.7%) had miscellaneous chronic pain problems, back pain and musculoskeletal pain excluded (e.g., headache, abdominal pain, facial pain, thoracic pain). The mean duration of the pain complaints was 6.8 years ($SD = 8.4$). Of the total sample, 9.5% were on sick leave, 28.9% received financial disability compensation, and 61.6% received no compensation. In addition, 11.1% of the participants used supportive equipment for ambulation (brace, crutches, corset, etc.), and 1.9% of the participants were dependent on a wheelchair or electric scooter for ambulation. As part of the standard intake procedure, participants were asked to complete a number of questionnaires.

Measures

Physical impairment

The Medical Examination and Diagnostic Information Coding System (MEDICS)³² was used. MEDICS is a

^{||}Physical impairment is defined as “an anatomical or pathological abnormality leading to loss of normal body ability.”

[¶]Nonorganic signs are defined as “behaviors elicited during an orthopedic examination procedure which deviate from anatomical principles.” Nonorganic symptoms are defined as “endorsement of symptoms which are exaggerated and do not conform to anatomy or disease course.”

method that is designed to quantify the extent of physical findings in chronic pain patients. From this system, a pathology index can be computed, which is a weighted logit score based on 18 common biomedical procedures (e.g., computed tomography scan, muscular function, neurologic examination) used in the assessment of the causes of pain in chronic pain patients. For this purpose, a fourth-year medical student, supervised by a neurologist (W.E.J.W.), examined the medical chart of every patient included in this study before completing MEDICS. The total pathology score, using the medical consensus weights reported by Rudy et al.,³² was used. This score is indicative of the level of physical impairment.

Pain intensity

The Dutch language version (DLV)³³ of the West Haven Yale Multidimensional Pain Inventory (MPI, formerly the WHYMPI)³⁴ was selected. It is a measure of key aspects of the chronic pain experience, based on the cognitive-behavioral perspective. The questionnaire consists of three major parts, each containing several subscales. The 13 subscales of the MPI-DLV assess pain intensity, pain-related interference, perceived life control, affective distress, social support, responses of significant others to the patient's pain behaviors, and level of participation in typical daily activities. Psychometric properties of the MPI-DLV are satisfying. The temporal stability ($r^2 = .81$) and the internal consistency (Cronbach $\alpha = .81$) of the pain intensity subscale is adequate.³³ Data on construct validity are also adequate. Furthermore, psychometric properties of the DLV are roughly the same as the American version.

Disability

One of the most widely used instruments for measuring disability, the Roland Disability Questionnaire,³⁵ could not be used in this study because it is specifically developed for use with low back pain patients. For practical reasons, the MPI subscales "interference" and "life control" were used in this study as an indicator for pain-related disability. Flor and Turk¹⁸ also used the "interference" subscale to measure disability in a study predicting pain and disability from cognitive variables. With respect to content, the items of the "life control" subscale seem to correspond to the World Health Organization definition of disability as well. Therefore, it was decided to use both the "interference" and the "life control" subscales as an indicator for disability. The temporal stability (r^2) of these subscales is adequate (0.88 and 0.78, respectively), as is the internal consistency (0.86 and 0.78, respectively).

Pain catastrophizing

In this study, we used the Dutch version (an unpublished, 1996 translation by G. Crombez and JWS Vlaeyen) of the Pain Catastrophizing Scale (PCS).³⁶ This is a 13-item scale in which participants are asked to reflect on past painful experiences and indicate the degree to which they experienced thoughts or feelings during pain on a five-point scale. Psychometric properties of the Dutch version of the PCS are adequate. It correlates highly ($r = 0.73$) with the catastrophizing subscale of the Dutch Pain Cognition List,³⁷ has a good temporal stability (Pearson $r^2 = 0.92$), and a high internal consistency (Cronbach $\alpha = 0.85$).³⁸

Psychological distress

We used the Dutch version³⁹ of the Symptom Checklist (SCL-90).^{40,41} This is a 90-item multidimensional state measure of psychopathology. The SCL-90 consists of eight dimensions: anxiety, agoraphobia, depression, somatic symptoms, distrust and interpersonal sensitivity, anger-hostility, sleeping problems, and general psychopathology/psychoneuroticism, which is expressed in the SCL-90 total score. We used the SCL-90 total score as a measure of psychological distress. Participants were asked to indicate on a five-point scale to what extent the symptoms as stated in the 90 items applied to them during the past week. Reliability and validity of the Dutch version of the SCL-90 were found to be adequate.³⁹

Statistical analysis

In addition to physical impairment, pain duration, age, and gender were used in the regression analyses as covariates. A longer duration of pain might go together with more disability and psychological distress. Similarly, apart from any pain-related disability, older people might be more disabled because, in general, people develop more health problems with increasing age. The relation between gender and pain intensity is not unequivocal (see Discussion). To rule out the possibility that gender influences the relations of interest, we considered gender as a covariate in the analyses.

Pearson correlations between catastrophizing, control variables (physical impairment, pain duration, age, and gender), and dependent variables (pain intensity, interference, life control, and psychological distress), and among independent and control variables were calculated.

We performed two series of stepwise hierarchical multiple regression analyses to examine whether catastrophizing would contribute significantly to the variance in the dependent variables, after controlling for physical impairment, pain duration, age, and gender, and to examine whether the relations between catastrophizing and the dependent variables differed for the three subgroups of chronic pain patients. In the first series, we entered the

control variables in the equation first, the main effect (catastrophizing) in the second step, and the interaction terms (pain group \times catastrophizing) in the third step. The pain group \times catastrophizing interaction terms were calculated using dummy coding. In the second series, only the main effects were tested after controlling for physical impairment, pain duration, age, and gender.

Based on the results of the regression analyses, we performed post hoc statistical analyses. Gender differences in self-reported pain were examined with the independent-samples *t* test. To examine whether gender moderates the relation between catastrophizing and pain intensity, we performed a stepwise hierarchical regression analysis with the control variables entered in the first step, the main effect (catastrophizing) entered in the second step, and the interaction term (gender \times catastrophizing) entered in the third step.

RESULTS

Correlations between the independent variable (catastrophizing), control variables (physical impairment, pain duration, age, and gender), and dependent variables (pain intensity, interference, life control, and psychological distress) are shown in Table 1. Correlations of catastrophizing with the dependent variables "interference" ($r = 0.434, p < 0.01$), "life control" ($r = -0.475, p < 0.01$), and "psychological distress" ($r = 0.544, p < 0.01$) are considerable. Correlation of catastrophizing with pain intensity is smaller but still significant ($r = 0.299, p < 0.01$). This indicates that chronic pain patients who catastrophize experience more pain intensity, feel more disabled by their pain problems (i.e., they experience more interference of their pain in daily life and experience less control over their lives), and are more psychologically distressed. The correlation between catastrophizing and physical impairment is not significant ($r = 0.029$, two-tailed, nonsignificant). Otherwise, physical impairment only correlates significantly with age ($r = 0.160$, two-tailed, $p < 0.05$), although this correlation is only very weak.

The results of the regression analyses demonstrated that there were no significant interaction effects (Table 2), indicating that the subgroups of chronic pain patients did not differ from each other with respect to the relation between catastrophizing and pain intensity, interference, life control, and psychological distress. The results of the second series of regression analyses are summarized in Table 3. Catastrophizing significantly predicts pain intensity ($\beta = 0.268, p < 0.01$), interference ($\beta = 0.439, p < 0.01$), life control ($\beta = -0.466, p < 0.01$), and psychological distress ($\beta = 0.566, p < 0.01$), even when controlled for physical impairment, pain duration, age, and gender. Nevertheless, in addition to catastrophizing, physical impairment significantly adds to the prediction of pain intensity ($\beta = 0.154, p < 0.05$) and interference ($\beta = 0.145, p < 0.05$). This means that the patients who are more physically impaired experience more pain intensity and interference from their pain in daily life. In addition to catastrophizing, age significantly adds to the prediction of interference ($\beta = -0.212, p < 0.01$), life control ($\beta = 0.184, p < 0.01$), and psychological distress ($\beta = -0.267, p < 0.01$), indicating that older people experience less interference and more life control and are less psychologically distressed. Finally, in addition to catastrophizing, gender significantly and uniquely adds to the prediction of pain intensity ($\beta = -0.267, p < 0.01$), with women reporting more pain intensity than men ($t_{208} = -3.077, p < 0.01$). No interaction effect between catastrophizing and gender was found ($F_{1,175} = .017, p = 0.896$) in predicting pain intensity.

DISCUSSION

As hypothesized, this study demonstrates that chronic pain patients who catastrophize experience more pain intensity, feel more disabled by their pain problem, and experience more psychological distress. Overall, catastrophizing is a potent predictor of pain intensity, disability, and psychological distress. CLBP patients, patients with chronic musculoskeletal pain other than low

TABLE 1. Correlations between independent variable (catastrophizing), control variables (physical impairment, pain duration, age, and gender), and dependent variables (pain intensity, interference, life control, and psychological distress)

Independent and control variables	Dependent variables			
	Pain intensity	Interference	Life control	Psychological distress
Catastrophizing	0.299*	0.434*	-0.475*	0.544*
Physical impairment	0.142	0.119	-0.046	-0.023
Pain duration	-0.064	-0.049	0.172†	-0.090
Age	0.005	-0.111	0.119	-0.134
Gender	-0.209†	-0.118	0.126	-0.156†

* $p < 0.01$ (one-tailed).

† $p < 0.05$.

TABLE 2. *F change values from the hierarchical regression analyses of the interaction effects (catastrophizing × group membership) with the dependent variables (pain intensity, interference, life control, and psychological distress)*

Dependent variables	F Change	Significance of F change
Pain intensity	0.192 (2, 174)	0.826
Interference	1.833 (2, 174)	0.163
Life control	1.403 (2, 174)	0.249
Psychological distress	1.526 (2, 173)	0.220

back, and patients with miscellaneous chronic pain problems do not differ from each other in this respect.

The results of the regression analyses are in strong support of the cognitive-behavioral model of catastrophizing and fear of movement/(re)injury,³ and demonstrate that physical impairment is not an important confounding variable. Nevertheless, physical impairment makes a modest but still unique contribution to the variance of pain intensity and interference in addition to the contribution made by catastrophizing. Furthermore, in addition to catastrophizing, age uniquely added to the prediction of disability and psychological distress, whereas gender uniquely added to the prediction of pain intensity, with women reporting more pain intensity than men. Apparently, older people feel less disabled by their pain problem and experience less psychological distress. It is plausible that with increasing age, patients come to terms more with their pain problem or simply are less hampered by their disability because of a more restricted range of activities in relation to their age.

The fact that women report more pain intensity than men is in line with the results of a recent study by Keefe et al.,⁴² who also found the relation of gender to pain to

be mediated by catastrophizing. They explained this by referring to research findings that indicate that pain responses are socialized differently in boys and girls, favoring a more catastrophic style in girls. On the other hand, Edwards et al.⁴³ did not find gender differences in self-reported pain. However, they did find a gender-specific effect of pain-related anxiety on pain intensity, with highly anxious male patients with chronic pain reporting more pain intensity than less anxious males with chronic pain. This effect was not found among female chronic pain patients. In the current study, however, no such moderating effect between gender and catastrophizing was found. Apparently, the relation of gender to pain is rather complex and yields diverse results in different studies. Clearly, more research on this subject is needed.

The correlation between catastrophizing and physical impairment found in this study is negligibly small ($r = 0.029$, nonsignificant). This finding is different from the findings of the two studies mentioned in the Introduction, which suggest significant relations between these two variables.^{13,14} A possible explanation for these divergent results is that the validity of the instrument used to measure objective physical impairment in the aforementioned two studies is questionable. In both studies, objective physical impairment was determined using the method developed by Waddell and Main,⁴ who used regression analysis to select a combination of physical characteristics (such as root compression signs) that gave the best prediction of disability. Each of these physical characteristics was given a different loading obtained from the regression coefficients. Combined, an impairment index can be calculated ranging from 0% to 40%.⁴

TABLE 3. *Summary of stepwise hierarchical regression analyses of pain intensity, interference, life control, and psychological distress with physical impairment, pain duration, age, and gender entered in the first step and catastrophizing entered in the second step*

Step	Independent and control variables	Dependent variables											
		Pain intensity			Interference			Life control			Psychological distress		
		Adj. R ²	R ²	β	Adj. R ²	R ²	β	Adj. R ²	R ²	β	Adj. R ²	R ²	β
1		0.091	0.111		0.033	0.054		0.027	0.049		0.047	0.068	
	Physical impairment			0.159†			0.154†			-0.079			0.001
	Pain duration			-0.086			-0.056			0.148†			-0.085
	Age			0.053			-0.133			0.099			-0.164†
	Gender			-0.292*			-0.124			0.100			-0.157†
2		0.156	0.179		0.216	0.238		0.234	0.255		0.354	0.372	
	Physical impairment			0.154†			0.145†			-0.070			-0.010
	Pain duration			-0.051			0.000			0.088			-0.014
	Age			0.005			-0.212*			0.184*			-0.267*
	Gender			-0.267*			-0.083			0.057			-0.105
	Catastrophizing			0.268*			0.439*			-0.466*			0.566*

* $p < 0.01$.

† $p < 0.05$.

It can be argued, however, that this method measures functional rather than physical impairment. Most of the physical characteristics used in the impairment index (e.g., lumbar flexion in centimeters, root compression signs) are determined on present clinical examination and thus are indicative of the actual and present status of a patient that might, as Reesor and Craig¹⁴ argued, be more functional in nature. Furthermore, by selecting the combination of physical characteristics that have the greatest influence on disability, there might be considerable confounding of the impairment index with disability, which is of course a behavioral (pain) variable.

In the current study, the MEDICS system³² was used to measure physical impairment. It has the advantage that it can be completed from the patients' medical charts. This means that even physical findings dating from the initial phase of the patient's pain problem can be taken into consideration and that the system can be used independently of the patient's present clinical status.

CONCLUSIONS

In summarizing the major findings of this study, a number of tentative conclusions can be drawn. First, catastrophizing appears to be an important factor in the chronic pain experience as a potent predictor of pain intensity, disability, and psychological distress. There appears to be no differences in this respect between CLBP patients, patients with chronic musculoskeletal pain other than low back pain, and patients with miscellaneous chronic pain problems, back pain and musculoskeletal pain excluded. Furthermore, the relation between catastrophizing and pain intensity, disability, and psychological distress is not confounded by physical impairment, although physical impairment makes a unique but modest contribution to the prediction of pain intensity and interference. Second, there is no relation between the level of objective physical impairment and catastrophizing. Third, the results of this study are in support of the cognitive-behavioral model of catastrophizing and fear of movement/(re)injury.³ Fourth, the MEDICS system as developed by Rudy et al.³² appears to be a useful instrument for measuring objective physical impairment. The method developed by Waddell and Main⁴ is hypothesized to be a measure of functional impairment.

The findings of this study also have some clinical implications. A general implication is that the role of physical impairment in the chronic pain experience, modest though it might be, perhaps has become slightly underestimated or neglected in recent years. Given the growing body of evidence concerning the importance of cognitive-behavioral factors in chronic pain, it is prob-

ably less obvious to consider a physical cause when a chronic pain patient displays extensive pain behavior and is severely disabled. Nevertheless, in cases of substantial exacerbation of pain and/or interference from pain, it might be advisable to have patients physically (re)examined. Another implication concerns the classification of patients in relation to customizing treatment. As becomes clear from this study, there appears to be a subgroup of chronic pain patients who, despite different medical diagnoses, are similar: they catastrophize their pain, which is closely related to more pain intensity, more pain-related disability, and more psychological distress in comparison with noncatastrophizing chronic pain patients. Therefore, the PCS might be useful as a screening instrument to select similar subgroups of chronic pain patients for treatment matched to the specific characteristics of these patients. Such an approach is closely in line with that of Turk,⁴⁴ who condemns the so-called "patient and treatment uniformity myths" and advocates a "subgroup customizing" approach. Interestingly, the profile of catastrophizing chronic pain patients (more pain intensity, disability, and psychological distress) in this study closely resembles the profile of the "dysfunctional" subgroup of the multi-axial assessment of pain taxonomy.⁴⁴

In conclusion, a number of critical remarks must be made concerning the current study. First, the study is designed in a cross-sectional manner, and positive correlations or regression weights, however significant, are not to be confused with causal relations. Nevertheless, it is plausible to assume that catastrophizing promotes self-reported pain intensity, disability, and psychological distress, although logically, the opposite might be true as well. In addition, the results of the current study do corroborate the findings of previously mentioned studies (e.g., Reesor et al.¹⁴ and Vlaeyen et al.).³ In this respect, the prospective studies by Burton et al.,²⁷ Klenerman et al.,²⁸ and Linton et al.^{29,30} support the idea that catastrophizing and pain-related fear are precursors of pain-related disability rather than consequences. Nevertheless, there is a need for experimentally designed studies in which the level of catastrophizing is manipulated and the effects of this manipulation on pain variables such as disability, but also on behavioral measures such as approach or avoidance in a behavioral task, are examined. Second, pain intensity was solely measured with the MPI "pain intensity" subscale, which is a verbal rating scale, whereas it might have been more appropriate to also use a visual analog scale.⁴⁵ In addition, the MPI "interference" and "life control" subscales were used as an indicator of pain-related disability instead of using a more direct measure of pain-related disability. Finally, all of the

measures used in this study are self-report measures, which by definition are dependent on a person's subjective judgment and may consequently be subjective to several kinds of bias, such as shared method variance. The use of behavioral measures in combination with self-report measures will strengthen the results of studies on chronic pain. However, a recent study by Jensen et al.⁴⁶ suggested that shared method variance does not entirely explain the relation between patient-reported pain beliefs and patient-reported measures of functioning (among which is disability).

Regardless of these shortcomings, our study shows that catastrophizing appears to be a crucial cognitive pain variable and probably plays a substantial role in a cognitive-behavioral conceptualization of chronic pain-related disability.

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