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The Key Role of Pain Catastrophizing in the Disability of Patients with Acute Back Pain

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Abstract
Purpose This study investigated the role of anxiety sensitivity, resilience, pain catastrophizing, depression, pain fear-avoidance beliefs, and pain intensity in patients with acute back pain-related disability.
Method Two hundred and thirty-two patients with acute back pain completed questionnaires on anxiety sensitivity, resilience, pain catastrophizing, fear-avoidance beliefs, depression, pain intensity, and disability.
Results A structural equation modelling analysis revealed that anxiety sensitivity was associated with pain catastrophizing, and resilience was associated with lower levels of depression. Pain catastrophizing was positively associated with fear-avoidance beliefs and pain intensity. Depression was associated with fear-avoidance beliefs, but was not associated with pain intensity. Finally, catastrophizing, fear-avoidance beliefs, and pain intensity were positively and significantly associated with acute back pain-related disability.
Conclusion Although fear-avoidance beliefs and pain intensity were associated with disability, the results showed that pain catastrophizing was a central variable in the pain experience and had significant direct associations with disability when pain was acute. Anxiety sensitivity appeared to be an important antecedent of catastrophizing, whereas the influence of resilience on the acute back pain experience was limited to its relationship with depression.

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Keywords Acute pain · Anxiety sensitivity · Fear-avoidance beliefs · Catastrophizing · Resilience · Disability

Introduction

The fear-avoidance model offers a theoretical explanation of the process by which acute pain may develop into chronic pain disability [1–6]. The fear-avoidance model [3] originally incorporated anxiety sensitivity as a variable that increased the probability of developing fear of pain. Anxiety sensitivity is the fear of bodily sensations due to beliefs that these sensations will have negative somatic, cognitive, or social consequences [7]. Understood as a general propensity to develop fears, anxiety sensitivity has been proposed as a stable individual variable that would explain individual differences in fear of pain [1].

In a later formulation of the fear-avoidance model, the relationship between anxiety sensitivity and fear of pain was thought to be mediated by catastrophic cognitions [8]. Furthermore, fear-avoidance models suggest that individuals who engage in catastrophic thinking become fearful of pain and avoid any movement and activity that may provoke pain. This leads to their disengaging from meaningful activities and to disability [1–3]. Therefore, as Gheldof et al. [9] suggested, the fear-avoidance model could explain why only a minority of individuals with acute low back pain develop chronic pain problems. Several prospective [10, 11], experimental [12], and cross-sectional [13] studies have shown that elevated fear-avoidance beliefs may play a central role in maintaining pain in patients with acute back pain, which is a significant predictor of future disability in these patients. Fritz [10] and Klenerman et al. [11] analysed the role of fear-avoidance beliefs in patients with acute low back pain. Fritz [10] assessed the relationship between fear-avoidance beliefs and future

work status, using hierarchical logistic regression models, in a sample of 78 subjects with low back pain of less than 3 weeks duration**.** The results showed that fear-avoidance beliefs about work were significant predictors of 4-week disability and work status even after controlling for initial levels of pain intensity, physical impairment, and disability. Klenerman et al. [11] collected psychosocial and physiological data (including fear-avoidance measures) from a sample of 300 acute low back pain patients within 1 week of presentation and at 2 months, to try to predict a 12-month outcome. Using multiple regression analyses, the results suggest that fear-avoidance variables were the most successful in predicting outcome**.** Both prospective studies concluded that fear-avoidance beliefs may be an important factor in explaining the transition from acute to chronic conditions.

Fear-avoidance beliefs and catastrophizing are reported to occur in moderate levels in the general population and can increase the risk of a new episode of back pain [14]. Picavet et al. [15] studied whether pain catastrophizing and fear of movement/(re)injury are important in the aetiology of chronic low back pain and associated disability. A total of 1571 people of general population participated and the results showed that for subjects with low back pain at baseline, a high level of pain catastrophizing predicted low back pain at 6 months follow-up. Also, high level of fear showed similar associations. The significant associations remained after adjustment for pain duration, pain severity, or disability at baseline. Therefore, fear-avoidance beliefs and catastrophizing seem to be risk factors for future disability in pain-free, acute pain, and chronic pain populations [14–18].

As fear-avoidance models have suggested, disability could be the consequence of avoiding any movement and activity that may provoke pain [1–3]. Therefore, acute disability provides opportunities for the reinforcement of pain behaviours, which could lead to long-term disability [19]. It is proposed that the development of a chronic pain problem involves an interaction between the injury, the experience of pain, and psychological factors; however, it remains unclear when and how these factors begin to predominate [4, 20]. A recent meta-analysis demonstrated a moderate-to-large cross-sectional association between pain-related fear and disability, among individuals experiencing acute or chronic pain [21]. The results of some studies have cast doubt on the specific sequential interrelationships postulated by the model. For example, Asmundson et al. [22] suggested that there are alternative psychological variables associated with pain-related disability that do not involve fear. In any case, the results of Wideman and Sullivan's study [23] showed that fear of movement was a predictor of work disability in a sample of individuals with subacute work-related musculoskeletal injuries. In addition, a systematic review provided evidence that fear-avoidance beliefs are a prognostic factor for work-related functioning in patients with subacute low back pain [24].

In the context of fear-avoidance models, several empirical studies have included dispositional characteristics and have acknowledged the importance of vulnerability factors such as anxiety sensitivity [2, 8, 25] and the influence of resilient resources [26–30]. Resilience has been defined as a multidimensional construct comprising constitutional variables such as temperament and personality accompanied by specific skills [31]. Davydov et al. [31] have referred to a range of studies that suggest that resilience can be seen as being synonymous with reduced vulnerability, with the ability to adapt to adversity, or with coping. Several studies have acknowledged the influence of resilience resources that may decrease sensitivity to acute pain [32, 33] and nurture adaptation to chronic pain [34, 35].

Generally, resilience is associated with less depression and greater well-being [28, 31].

Depression and pain intensity have also been suggested as important variables in the onset of pain chronicity. Pincus et al. [36, 37] suggested that pre-existing co-occurring depression could be another possible pathway to pain-related functional disability. Prospective studies that have included samples of patients in the acute/subacute phase to the chronic pain phase have also found that pain intensity is a consistent and robust predictor of disability [9, 23, 38, 39].

The aim of this study was to investigate the role of key psychological variables in acute pain disability. Research on the relationship between the variables included in the present study has mainly been conducted in populations with chronic pain disorders [28, 40]. As explained before, other prospective studies have analysed the influence of some relevant variables, such as pain intensity, fear avoidance, and catastrophizing in pain chronification [10, 11, 15]. However, to date, the association between perceived disability and anxiety sensitivity, resilience, catastrophizing, fear-avoidance beliefs, depression, and pain intensity has not been investigated in a population of patients who have experienced an episode of acute back pain.

Methods

A Cross-sectional Design Was Used

Hypotheses

Participants completed questionnaires on anxiety sensitivity, resilience, pain catastrophizing, fear-avoidance beliefs, pain intensity, depression, and disability. In order to simultaneously consider the influence of all the predictor variables on all the dependent variables, we performed multivariate multiple regression by structural equation modelling. Based on the aforementioned research, the following hypothetical model (Fig.1) was proposed:

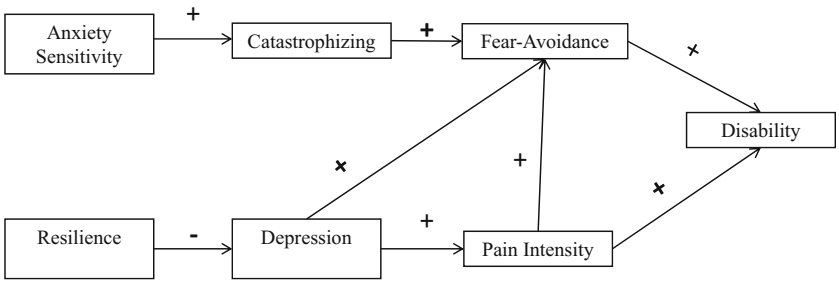

Fig. 1 Hypothetical model. Anxiety sensitivity would have a positive association with catastrophizing, whereas high levels of resilience would be associated with lower levels of depression. Catastrophizing of pain, depression, and pain intensity would be positively associated with fear-avoidance beliefs. Depression would have a positive association with pain intensity. Pain intensity and fear-avoidance beliefs would have a positive association with disability

Anxiety Sensitivity and Resilience

As suggested by the empirical literature on anxiety sensitivity [1–3; 8] and resilience [28, 31], it was postulated that high levels of anxiety sensitivity would be associated with high levels of catastrophizing, whereas high levels of resilience would be related with lower levels of depression.

Catastrophizing and Depression

Based on fear-avoidance model [8] the relationship between anxiety sensitivity and fear of pain was postulated to be mediated by catastrophic cognitions. Thus, it was hypothesised that catastrophizing would be related with higher levels of fear-avoidance. In line with Pincus et al. [36, 37], it was also postulated that high levels of depression would be related with high levels of fear-avoidance and pain intensity.

Pain Intensity, Fear Avoidance, and Disability

As suggested by several studies [9, 23, 38, 39], it was hypothesised that high levels of pain intensity would be associated with high levels of fear avoidance and high levels of disability. Finally, based on the fear-avoidance models [3, 8] and the empirical literature [15, 19], it was hypothesised that fear-avoidance beliefs would have a positive relationship with disability in the setting of acute back pain.

Figure 1 shows all the previously explained hypotheses in a hypothetical model.

Participants

General practitioners in five primary care units invited 266 patients with acute back pain to participate, of whom 12 refused participation. The reasons for non-participation were as follows: two patients did not reply to the phone calls, six patients stated they "had no time" for the assessment session, and four expressly refused participation. Therefore, 254 patients with acute back pain episodes were recruited. Acute back pain was defined as back pain of less than 3 months duration in patients who had been free of back pain during the 6 months preceding the current episode. Individuals were considered eligible for inclusion if they were not being treated for a malignancy, terminal illness, or psychiatric disorder, and were able to understand the Spanish language. Twenty-two of the participants who had been initially contacted were excluded from the study because they did not meet the inclusion criteria. In total, 232 patients participated in the study (157 women and 75 men). All the participants were Caucasian and their average age was 45.41 years (SD = 16.20). The most common sites of pain were cervical (44.80 %), followed by sacral (28.90 %), thoracic (21.60 %), lumbar (21.10 %), and leg below knee (3.0 %) (Table 1).

Procedure

This research project was approved by the C—Hospital Ethics Committee. To guarantee the standardisation of the recruitment process, the researchers held a meeting with the participating doctors in which the eligibility criteria were explained and the procedures were decided on.

At the end of their visit to their doctor, each patient who fulfilled the eligibility criteria was informed of the study aims and their participation was requested. Some patients were interviewed after their visit, whereas others left their telephone number to make an appointment on another day. Informed consent was obtained prior to data collection. The participants were aware that the information collected was confidential and that this information would be linked to a number alone and not to their name. Each participant had a semi-structured interview with a psychologist to obtain demographic, social, or medical history data. A battery of questionnaires was also completed by each participant. Patients were interviewed in their usual primary care centre.

Table 1 Demographic and clinical data ($N = 232$)

Variables	Mean (*N*)	SD (%)	Min/Max
Age	45.41	16.20	
Sex			
Male	(75)	(32.3)	
Female	(157)	(67.7)	
Site of Pain			
Cervical	(104)	(44.8)	
Thoracic	(50)	(21.6)	
Lumbar	(49)	(21.1)	
Sacral	(67)	(28.9)	
Leg below knee	(7)	(3.0)	
Time in Pain (1–90 days)	23.60	26.41	
Variables included in the model			
Resilience (RS)	145.90	12.94	25/175
Anxiety Sensitivity (ASI)	35.15	12.94	16/80
Catastrophizing (PCS)	22.85	8.93	13/58
Depression (HADS)[a]	11.26	5.10	7/28
Fear-Avoidance Beliefs (FABQ)	40.53	17.33	0/90
Pain Intensity	5.49	1.81	0/10
Disability (RDQ)	10.40	5.93	0/24

N number of patients (in brackets), *SD* standard deviation, % percentage of patients in brackets, *Min/Max* minimum and maximum scores

[a] For the depression scale, raw scores between 8 and 10 identify mild cases, 11 to 15 moderate cases, and 16 or above severe cases [49]

Measures

Anxiety Sensitivity Index (ASI)

This index is a 16-item questionnaire in which respondents indicate the degree to which they fear the negative consequences of anxiety symptoms on a 5-point Likert-type scale [41]. The Spanish version of the ASI is fully equivalent to the original. The results of validation studies provide cross-cultural evidence for construct validity and the concurrent validity of the Spanish ASI [42]. The instrument showed high reliability in this study ($\alpha = .92$).

The Resilience Scale (RS)

This scale consists of 25 items arranged in two subscales: personal competence (17 items) and acceptance of self and life (eight items) [43]. The construct validity of the RS was supported by correlations with measures of self-esteem and perceived stress. The RS has been adapted into Spanish for patients with chronic musculoskeletal pain [44]. This version has good internal consistency and test-retest reliability. Furthermore, the scale shows good concurrent validity with measures of adjustment to chronic pain. In the present study $\alpha = .88$.

Pain Catastrophizing Scale (PCS)

This scale is a 13-item measure in which respondents indicate on a 5-point scale the degree to which they experience various thoughts and feelings while in pain [45]. It consists of three subscales assessing rumination, magnification, and helplessness and also provides a total score on catastrophizing. The Spanish version of the scale shows appropriate reliability and validity (rumination, $\alpha = .89$; helplessness, $\alpha = .90$; magnification, $\alpha = .79$; total PCS, $\alpha = .95$) [46]. The total score alone was used in this study. In the present study $\alpha = .93$.

Fear-Avoidance Beliefs Questionnaire (FABQ)

The FABQ [47] is based on theories of fear and avoidance behaviour and addresses patients' beliefs on how physical activity and work affect their pain. It includes two subscales: fear-avoidance beliefs about work (FABQ-Work, $\alpha = .88$) and fear-avoidance beliefs about physical activity (FABQ-Phy, $\alpha = .77$). The Spanish version of the FABQ [48] consists of 15 items, related to physical activity and work. The patient has to rate each sentence from 0 (totally disagree) to 6 (totally agree). Kovacs et al. [48] suggested that the complete questionnaire is as good as its subscales for determining fear avoidance beliefs related to work and physical activity, and that it has high internal consistency ($\alpha = .93$). The total score alone was used in this study (in the present study $\alpha = .84$).

Hospital Anxiety and Depression Scale (HADS)

This is a self-reporting scale that contains two 7-item scales, one for anxiety and one for depression [49]. The depression scale was used in this study. The Spanish version of the scale shows appropriate reliability and validity. The internal consistency of both scales is high ($\alpha = .86$ for anxiety; $\alpha = .86$ for depression) [50]. The depression score alone was used in the present study ($\alpha = .81$).

Pain Intensity

Patients were asked to rate their mildest, average, and worst pain during the past 2 weeks, as well as their current pain, on a scale ranging from 0 to 10, with "0" indicating "no pain" and "10" indicating pain as "intense as you could imagine". A composite pain intensity score was calculated for each subject by calculating the average of the mildest, average, worst, and current pain. Composites of the 0–10 ratings are very reliable measures of pain intensity in chronic pain patients [51]. In the present study $\alpha = .81$.

Roland-Morris Questionnaire (RMQ)

This questionnaire consists of 24 items, which reflect limitations in different daily activities attributed by the patient to low back pain [52]. The patient has to mark each item that applies to his or her current status. The Spanish version [53] has adequate internal consistency (between α = .83 and α = .94) and the ability to predict self-reported pain intensity and quality of life. In the present study α = .89.

Statistical Analysis

Firstly, we analysed correlations between the observed variables included in the model. The hypothetical model (Fig. 1) was then tested via structural equation modelling (SEM) using LISREL 8.30 software.

Prior to the analyses, the data were checked and no problems were encountered regarding the shape of the frequency distributions or outliers. The variables were normally distributed, and generally weighted least squares was used as the estimation method. Analyses were performed on the polychoric correlation matrix. Following the recommendations of Bollen and Long [54], several goodness-of-fit indexes were considered. The Satorra-Bentler chi-square is a chi-square fit index that corrects the statistic under distributional violations [55]. To reduce the sensitivity of chi-square to sample size, the index is divided by the degrees of freedom. Ratios of 3 or smaller are indicative of an acceptable fit of the model [56]. The comparative fit index (*CFI*) and the non-normed fit index (*NNFI)*, [57] measure the proportional improvement in fit by comparing a hypothesised model with a more restricted baseline model (a null model is the most commonly used baseline model). The CFI and NNFI range from 0 (absolute lack of fit) to 1 (perfect fit) and fit is considered to be good when the values are greater than .90 [58]. The root mean-square error of approximation (*RMSEA*) is an absolute misfit index; the closer to zero, the better the fit. Values less than .08 indicate an adequate fit [58, 59]. The goodness-of-fit index (*GFI*) and the adjusted goodness-of-fit index (*AGFI*) both range between 0 and 1, where the closer to 1, the better the fit.

Endogenous variables were catastrophizing, depression, fear-avoidance beliefs, pain intensity, and disability. Anxiety sensitivity and resilience were included as exogenous variables. LISREL software estimates the path coefficients that indicate the magnitude of the contribution of each exogenous variable to the endogenous variable. Table 2 shows the standardised path coefficients, χ^2, and degrees of freedom found in the initial model. Table 2 includes just the relations that were postulated and later were analysed.

Results

Correlation Analyses

Table 3 presents the correlations between variables included in the hypothetical model. Correlations were assessed following the guidelines proposed by Cohen [60], wherein low correlations range from .10 to .29, moderate correlations from .30 to .49, and high correlations from .50 to 1.

As shown in the table, no correlations were found between resilience and most of the variables included in the analysis. The only significant correlation was a low negative

Table 2 Initial model

Standardized path coefficients					
Initial model	Endogenous variables				
	Catastrophizing	Depression	Fear-avoidance beliefs	Pain intensity	Disability
Exogenous variables					
Anxiety sensitivity	.48				
Resilience		−.16			
Endogenous variables					
Catastrophizing			.25		
Depression			.09	.10	
Fear-avoidance beliefs					.25
Pain intensity			.13		.32
			χ^2 = 70.76	*df* = 12	*p* = .000

Standardised path coefficients, χ2, and degrees of freedom found in the initial model. Only includes the relationships that were postulated and later analysed

Table 3 Correlation matrix

	Resilience	Anxiety sensitivity	Catastrophizing	Depression	Fear avoidance	Pain intensity	Disability
Resilience	1						
Anxiety sensitivity	−.11	1					
Catastrophizing	−.09	.48**	1				
Depression	−.16*	.20**	.17**	1			
Fear avoidance	−.00	.14*	.30**	.14*	1		
Pain intensity	−.01	.12	.32**	.10	.21**	1	
Disability	−.05	.20**	.50**	.18**	.32**	.37**	1

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

association between resilience and depression ($r = -0.16$). Anxiety sensitivity had a moderate correlation with catastrophizing ($r = 0.48$) and low associations with depression ($r = 0.20$), fear-avoidance beliefs ($r = 0.14$), and disability ($r = 0.20$). Catastrophizing had a low correlation with depression ($r = 0.17$), moderate correlations with fear-avoidance beliefs ($r = 0.30$) and pain intensity ($r = 0.32$), and a high correlation with disability ($r = 0.50$). Depression had low correlations with fear-avoidance beliefs ($r = 0.14$) and disability ($r = 0.18$). Fear-avoidance beliefs had low and moderate correlations with pain intensity ($r = 0.21$) and disability ($r = 0.32$). Finally, pain intensity had a moderate correlation with disability ($r = 0.37$).

Evaluation of the structural model

To obtain a parsimonious model of the relationships between anxiety sensitivity, resilience, catastrophizing, depression, fear-avoidance beliefs, pain intensity, and disability, we examined the path coefficients for the initial model and eliminated all paths that were not statistically significant. Thus, the paths from depression to pain intensity and from pain intensity to fear-avoidance beliefs were excluded from the model.

Two relationships suggested by the modification indexes were included in the final model: a path from catastrophizing to pain intensity and one from catastrophizing to disability. All the suggested paths are plausible [61] and refer to relationships between variables that were not considered in the initial model.

Figure 2 represents the final model. All path coefficients were statistically significant ($p < 0.05$). The goodness-of-fit indexes calculated for the SEM indicate that the estimated model provides a good fit to the data (χ^2 (12) = 18.17, χ^2/dL = 1.51, $p = .14$; root mean-square error of approximation (RMSEA) = .047; goodness-of-fit index (GFI) = .98; adjusted goodness-of-fit index (AGFI) = .96; comparative fit index (CFI) = .99; and non-normed fit index (NNFI) = .96).

The resulting model suggested that the hypotheses were only partially confirmed.

Anxiety Sensitivity and Resilience

As stated in the hypothetical model, anxiety sensitivity yielded a statistically significant path coefficient to catastrophizing, with individuals characterized by higher levels of anxiety sensitivity reporting higher levels of catastrophizing ($\gamma = 0.48$). As postulated, resilience yielded a statistically significant path coefficient to depression, with individuals characterized by higher levels of resilience reporting lower levels of depression ($\gamma = -0.16$).

Catastrophizing and Depression

As expected, catastrophizing had statistically significant effects on fear-avoidance beliefs, with fear-avoidance tending to increase as catastrophizing increased ($\beta = 0.29$). However, as suggested by the modification indexes, there were two unexpected associations in the final model: a path from catastrophizing to pain intensity and one from catastrophizing to disability. Thus, patients with high levels of catastrophizing manifest more pain intensity ($\beta = 0.32$) and higher disability ($\beta = 0.39$).

The results on the role of depression did not confirm the previous hypotheses. There was no association between depression and pain intensity, and therefore, the hypotheses were rejected. However, an expected, low, positive, and statistically significant path coefficient was found from depression to fear-avoidance beliefs ($\beta = 0.10$).

Pain Intensity, Fear Avoidance, and Disability

Finally, as stated in the hypothetical model, pain intensity and fear-avoidance beliefs yielded statistically significant path coefficients to disability. Thus, high levels of pain intensity were associated with high levels of disability ($\beta = 0.21$), and patients with high levels of fear avoidance also manifested more disability ($\beta = 0.16$). However, contrary to expectations, pain intensity did not seem to have any association with fear avoidance.

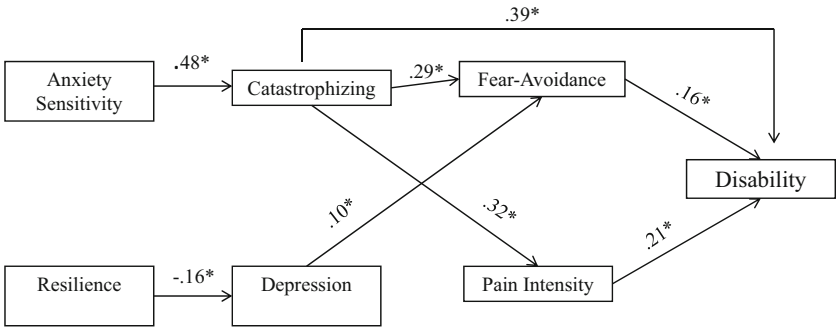

Fig. 2 Final model. Standardised γ and β-coefficients.*$p \leq 0.05$. Observed variables are represented by *squares*. Anxiety sensitivity yielded a statistically significant path coefficient to catastrophizing, ($\gamma = 0.48$). Resilience yielded a statistically significant path coefficient to depression ($\gamma = -0.16$). Patients with high levels of catastrophizing manifest more fear avoidance beliefs ($\beta = 0.29$), more pain intensity ($\beta = 0.32$), and higher disability ($\beta = 0.39$). A statistically significant path coefficient was found from depression to fear-avoidance beliefs ($\beta = 0.10$). Pain intensity and fear-avoidance beliefs yielded statistically significant path coefficients to disability ($\beta = 0.21$; $\beta = 0.16$)

Discussion

The aim of this study was to investigate the association between perceived disability and catastrophizing, fear-avoidance beliefs, depression, and pain intensity in a population of patients with an episode of acute back pain. The results showed that anxiety sensitivity was associated with pain catastrophizing, and resilience was associated with lower levels of depression. Pain catastrophizing was positively associated with fear-avoidance beliefs and with pain intensity. Depression was associated with fear-avoidance beliefs, but not with pain intensity. Finally, catastrophizing, fear-avoidance beliefs, and pain intensity were positively and significantly associated with acute back pain-related disability.

Anxiety Sensitivity and Resilience

The study of diathesis variables is crucial to the early identification of people at risk of becoming disabled by pain [25, 62]. Anxiety sensitivity has been included in the fear-avoidance model as a vulnerability variable which could explain individual differences in fear of pain [2]. In contrast, resilience appears to be a personal resource that increases the patients' capacity to manage pain effectively [25, 28, 40]. As postulated, and in line with previous studies [31, 63], higher resilience was significantly associated with lower depression when pain was acute. This finding suggests that resilience could contribute to adjustment by fostering a better emotional state [28, 63]. It should be borne in mind that the path from resilience to depression was low ($\gamma = -0.16$). Although the role of resilience as a protective factor in individuals with chronic pain is well documented [24, 56], more research is needed on the role of resilience in acute pain.

Anxiety sensitivity, on the other hand, was associated with catastrophizing. The wide variability in patients' responses to the same degree of physical disease may be due to the influence of psychosocial variables prior to the pain experience that could be considered a source of individual differences. As Turk [64] stated, a range of cognitive, affective, and behavioural factors are related to the perception of pain, maintenance of pain and disability, exacerbation of pain, and response to treatment. From this perspective, as Crombez et al. suggested [65], patients at risk could be labelled as *avoiders* and those who recover as *confronters*. Therefore, in relation to prevention, patients with increased anxiety sensitivity should be identified during the first stages of pain as a matter of priority. Thus, it may be possible to change their tendency to engage in avoidance behaviour to one of engaging in confrontation behaviour.

Catastrophizing, Depression, Fear Avoidance, and Disability

According to the results, when pain was acute, fear-avoidance beliefs were significantly associated with disability. It must be borne in mind that the significant relationship between fear-avoidance beliefs, pain intensity, and disability decreases when, as indicated by the analysis, a path was specified between pain catastrophizing and disability. This suggests that the relationship between fear-avoidance beliefs and disability could be connected to their shared variance with catastrophizing, which may obscure an independent relationship during multivariate analysis [36]. The results highlighted the pivotal role of pain catastrophizing in the acute pain experience. As postulated by the fear-avoidance model [1–3], pain catastrophizing is a consistent antecedent of fear-avoidance beliefs, and it has significant direct associations with pain intensity and with disability when pain is acute.

Pain catastrophizing involves exaggerated maladaptive cognitions or emotions in response to ongoing, anticipated, or recalled pain [66, 67]. The detrimental role of catastrophizing in managing and coping with pain is well documented and catastrophizing is widely acknowledged as an important predictor of pain experience [68–71]. Findings are consistent across different study populations, including people with chronic pain as well as individuals experiencing acute or

experimental pain [16–18]. Research on the relationship between catastrophizing, pain-related fear, and disability has mainly been conducted in populations with chronic pain disorders, using perceived disability as the outcome measure. However, few studies have investigated the association between catastrophizing, fear-avoidance beliefs, depression, pain intensity, and perceived disability, in a population of patients with an episode of *acute* back pain. Regarding the role of depression, although no association was found between this variable and the intensity of pain, the results show a low but significant relation between depression and pain fear avoidance. As Pincus et al. [36] stated, depression constitutes a long-term, trait-like vulnerability and those high in depression who also report high levels of fear might be considered complex fear avoidant. Again, more investigation about the role of depression in acute pain patients is needed.

Pain Intensity, Fear Avoidance, and Disability

Previous studies on acute back pain [12] have found a very low association between pain intensity and fear avoidance. In the present study, the postulated relationship between these variables was not significant and was excluded from the final model. Thus, during the acute stage, the association between pain intensity and disability was not mediated by fear of pain, as suggested in previous studies [12, 38, 72]. There was a direct and positive relationship between pain intensity and disability. As Gheldof et al. [73] pointed out, a number of cross-sectional and prospective studies have provided evidence that the intensity of chronic pain is a key predictor of pain-associated disability. However, the evidence is less conclusive regarding the role of the intensity of acute low back pain in predicting self-reported disability [74, 75], functional status [19, 76, 77], and return to work [78]. According to a biopsychosocial model [79], in addition to pain, a wide range of biomedical, psychological, and social experiences has been shown to converge to produce diminished levels of disability and work loss [73, 80, 81]. As such, there is increasing acceptance that several psychological factors are of even more importance than biomechanical or physical factors in predicting future disability [38, 40, 73, 75]. Therefore, in addition to the direct and positive relationship between pain intensity and disability, it may be of relevance to clinicians to note the association between catastrophizing and pain intensity, since pain intensity could be reduced through the interventions on pain catastrophizing.

The results of this study may have important clinical implications. They support the opinion expressed by other pain researchers that fear-avoidance beliefs, catastrophizing, and disability should be identified at an early stage of back pain [3, 13, 81]. According to these results, catastrophizing has a key role in acute back pain experience. It may be the case that one of the most important goals in psychological pain interventions should be to reduce catastrophizing. If this aim is achieved, then it may be the case that pain intensity, fear-avoidance beliefs, and acute back pain-related disability would also be reduced. Moreover, a prospective study [19] suggested that acute disability could lead to long-term disability. Therefore, clinicians should pay special attention to patients who report high levels of disability when suffering acute back pain because they are at high risk of developing pain-related disability in the following months. The early identification and management of patients at risk for chronic back pain are major issues that deserve further research.

Finally, we wish to emphasize that a limitation of this study is the exclusive reliance on self-report measures. In addition, the research relied on cross-sectional measures, and therefore, the results cannot capture the dynamic process of pain coping, as has been pointed out by Keefe et al. [82]. The cross-sectional study design also means that causal relationships cannot be identified. Longitudinal research designed to follow catastrophizing, depression, fear-avoidance beliefs, pain intensity, and disability over time would help to develop causal models showing the influence of these variables on pain adjustment. Future research could also use longitudinal methods to investigate the function of resilience and anxiety sensitivity in the pain chronification process.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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