

## Catastrophizing, State Anxiety, Anger, and Depressive Symptoms Do Not Correlate with Disability when Variations of Trait Anxiety Are Taken into Account. A Study of Chronic Low Back Pain Patients Treated in Spanish Pain Units [NCT00360802]

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### Abstract

**Objectives.** To assess the influence of pain severity, catastrophizing, anger, anxiety, and depression on nonspecific low back pain (LBP)-related disability in Spanish patients with chronic LBP.

**Study Design.** Cross-sectional correlation between psychological variables and disability.

**Methods.** One hundred twenty-three patients treated for chronic LBP in pain units within nine Spanish National Health Service Hospitals, in eight cities, were included in this study. Intensity of LBP and pain referred to the leg, disability, catastrophizing, anger, state anxiety, trait anxiety, and depression were assessed through previously validated questionnaires. The association of disability with these variables, as well as gender, age, academic level, work status, and use of antidepressants, was analyzed through linear regression models.

**Results. Correlations between LBP, referred pain, disability, catastrophizing, anger, state anxiety, trait anxiety, and depression were significant, except for the ones between anger and LBP and between anger and referred pain. The multivariate regression model showed that when variations of trait anxiety were taken into account, the association of the other psychological variables with disability was no longer significant. The final model explained 49% of the variability of disability. Standardized coefficients were 0.452 for trait anxiety, 0.362 for intensity of LBP, 0.253 for failed back surgery, and -0.140 for higher academic level.**

**Conclusion. Among Spanish chronic LBP patients treated at pain units, the correlation of catastrophizing, state anxiety, anger, and depression with disability ceases to be significant when variations of trait anxiety are taken into account. Further studies with LBP patients should determine whether anxiety trait mediates the effects of the other variables, explore its prognostic value, and assess the therapeutic effect of reducing it.**

**Key Words. Low Back Pain; Disability; Anxiety; Catastrophizing; Depression**

## Introduction

Nonspecific or common low back pain (LBP) is defined as pain between the costal margins and the inferior gluteal folds, usually accompanied by painful limitation of movement and potentially associated with referred leg pain [1]. Diagnosing common LBP implies that the pain is not related to conditions such as fractures, spondylitis, direct trauma, or neoplastic, infectious, vascular, metabolic, or endocrine-related processes [1].

LBP generates a major individual, clinical, social, and economic burden in industrialized countries. Its lifetime prevalence is over 70% of the general population, and its yearly cost to society corresponds to approximately 1.7% of the gross national product [2]. Patients in whom LBP lasts for more than 3 months are considered to be chronic [3]. These represent less than 20% of LBP patients, but generate over 70% of total costs [2]. Chronic LBP affects 3.42% of European adults, and is the chief cause behind serious interferences with social and professional activities caused by chronic pain [4].

Pain-related disability is defined as the limitation in daily activities due to actual pain or fear of pain. It is the main cause of the social costs and loss of quality of life associated with LBP [1,5–7]. Previous studies have shown LBP-related disability to be influenced by pain severity and duration, as well as by an array of other psychological variables. Some studies suggest that certain psychological variables (catastrophizing, appraisals of control, fear-avoidance beliefs [FABs], etc.) influence LBP-related disability to a greater extent than pain severity [8–11], while others suggest the opposite [12–20]. Differences in

study populations and statistical methods used across studies (e.g., patients seeking care for LBP vs general or elderly population, use of hierarchical vs nonhierarchical regression models, etc.) may account for these apparent inconsistencies [8–20].

Preventing and improving disability is a major goal in LBP treatment. Exploring which psychological factors are associated with disability would be valuable for selecting patients for which psychological treatment is recommendable, as well as for optimizing treatment.

A variety of theories can explain the relationship between catastrophizing and pain and between catastrophizing and disability [21]. The transactional model of Lazarus and Folkman [22] postulates that the cognitive assessment of any event can trigger emotions (such as anxiety, sadness, or anger), which in turn can affect health [21]. Catastrophizing has been considered to be a type of cognitive assessment [21,23], as it shares some of the characteristics defined by Lazarus and Folkman for this concept (i.e., magnification, rumination, and defenselessness). This would suggest that catastrophizing might have an influence on pain or disability through emotions. In fact, the influence of catastrophizing on emotions is increasingly acknowledged [24–26].

Most studies have assessed the effect of catastrophizing on LBP-related disability [8,11–13,20,27–29], but only a few have focused on emotional variables such as anger, anxiety, or depression [9,18,29], which are often found in chronic pain patients [30]. No study has simultaneously analyzed the influence of catastrophizing, anxiety, anger, and depression on LBP-related disability.

Trait anxiety, neuroticism, and anxiety sensitivity can lower the threshold at which pain is perceived as threatening, and at which catastrophic thoughts and negative emotions emerge [30,31]. Therefore, in addition to catastrophizing, anxiety state, anger, and depression, anxiety trait might also correlate with disability.

Chronic patients are those who suffer the highest degrees of anxiety and depression [32–34]. Therefore, it was hypothesized that the effect of psychological variables on LBP-related disability would be more relevant among the most chronic cases.

As a result, the objective of this study was to assess the hypothesis that, among chronic patients treated for LBP in pain units, higher degrees of anxiety (state and trait), anger, depression, and catastrophizing were associated with higher degrees of disability.

## Methods

### Subjects

This study was conducted with chronic LBP patients treated in the pain units of nine hospitals belonging to the

## Low Back Pain, Disability, Anxiety, Depression, Catastrophizing, Anger

Spanish National Health Service, in eight different cities (Madrid, Sevilla, Palma de Mallorca, Sabadell, Santander, Tarrasa, Mahón, and Manacor).

This study was designed as a secondary analysis of data gathered in a randomized controlled clinical trial setup to assess the effectiveness of two psychological treatments (“cognitive behavioral treatment” and “mindfulness based stress reduction”) for LBP-related disability in Spanish chronic LBP patients treated at pain units. The high dropout rate made it impossible to follow up the patients, and led to the premature interruption of the trial. Therefore, only data gathered at baseline (before randomization) were analyzed to assess the association between disability and clinical (e.g., pain severity and duration), demographic (e.g., age, gender, academic level, employment status), and psychological (catastrophizing, anger, anxiety, and depression) variables.

Inclusion criteria were LBP for  $\geq 3$  months and signing the corresponding informed consent to participate in the study. Exclusion criteria were inability to answer the Spanish versions of the questionnaires used to assess pain, disability, and psychological variables (e.g., functional illiteracy or blindness), leaving one or more of the questionnaires assessing pain, disability or psychological variables, unanswered, treated or untreated central nervous system impairment, direct trauma to the spine, current involvement in lawsuits for LBP or in the process of obtaining disability pension for LBP, criteria for referral to surgery, and “red flags” for potential systemic disease. Criteria for referral to surgery were defined as signs suggesting cauda equina syndrome (sudden or progressive relevant motor deficit, sphincter impairment of neurologic cause, or saddle anesthesia), disabling sciatic pain for 6 or more weeks, in spite of all nonsurgical treatments, caused by a compromised nerve root demonstrated by magnetic resonance imaging (MRI) or computed tomography (CT) studies, or symptomatic spinal stenosis as defined by claudication unrelated to peripheral vascular disease with evidence of stenosis on MRI or CT scans [1]. Red flags for potential systemic disease were pain that appears for the first time before 20 or after 55 years of age, oncologic disease during the previous 5 years, constitutional symptoms (unexplained weight loss, fever, chills), recent urinary tract infection, history of intravenous drug use, or immunocompromised host [1].

Patients with “red flags” in whom appropriate diagnostic procedures had already excluded systemic diseases were included. Patients with chronic LBP associated with failed back surgery for common LBP (and not for symptomatic disk herniation or spinal stenosis) were also included, and identified as a subset of patients at the analysis phase.

### Procedure

The study protocol was approved by the Ethical Committees of the participating hospitals and institutions.

Between May 31, 2006 and October 24, 2007, 21 pain specialists working in the participating hospitals screened patients treated in their pain units for all inclusion and exclusion criteria, other than their acceptance to sign the corresponding informed consent. The study characteristics were explained to eligible patients by psychologists working for the study in each of the units, who asked the patients to sign the corresponding informed consent. Those who did so were included in the study.

Although patients’ acceptance or refusal to participate in this study had no effect on the health care they received, at the design phase of the study, it was decided that for ethical reasons, they would be invited to participate by a member of the study staff other than their treating physician.

After having been included, patients completed all the self-administered questionnaires on their own, in the absence of health care staff or third parties. Once completed, the questionnaires were collected by auxiliary personnel not related to the study. The data were entered in a database at a centralized coordination office by two administrative assistants who double-checked that the data entered coincided with the ratings of the questionnaires.

### Variables

Data on age (date of birth), gender, academic level (less than elementary school, elementary school, high school, university, analyzed as elementary school or lower vs high school or higher), marital status (married, single, widowed, divorced, and analyzed as married vs other), employment situation (employed, retired or unemployed, housewife, student or other), having undergone failed back surgery (yes/no), use of drugs (nonsteroidal anti-inflammatory drugs [NSAIDs], muscle relaxants, analgesics, opiates, antiepileptic drugs, antidepressants, steroids, analyzed as yes/no), other treatments (passive physiotherapy, health education, transcutaneous electrical stimulation (TENS), facet joint denervation, trigger point injections, facet injections, epidural injections, spine electrical stimulation, and other procedures, analyzed as yes/no), and duration of pain (days) were gathered.

Severity of LBP and pain referred to the leg (RP), disability, anxiety (trait and state), catastrophizing, depression, and anger were assessed through the previously validated Spanish versions of the following scales and questionnaires [35–40].

LBP and RP were assessed separately with two 10-cm visual analog scales [35]. The range of values is 0–10, with greater scores corresponding to greater levels of pain severity.

Disability was measured with the Roland–Morris Questionnaire [36], which measures the degree of limitation in daily activities attributed by the patient to LBP. For this 24-item questionnaire, the range of values is 0–24, with greater scores corresponding to greater levels of disability.

Anxiety was assessed with the State Trait Anxiety Inventory (STAI), which is a 40-item questionnaire composed of two subscales [37]. On the one hand, STAI-trait (STAI-T) subscale (20 items) measures the disposition toward anxiety as a personality trait, which is defined as the relatively stable individual differences in anxiety proneness. The stronger the anxiety trait, the higher the likelihood that a person will experience a state-anxiety reaction in a threatening situation [41]. On the other hand, STAI-state (STAI-S) (20 items) measures the intensity of anxiety as a current emotional state [37], which is defined as a temporal cross section in the emotional stream-of-life of a person, consisting of subjective feelings of tension, apprehension, nervousness, and worry, and activation or arousal of the autonomic nervous system [41]. For STAI (STAI-T and STAI-S), the range of values is 0–60, with greater scores corresponding to greater levels of anxiety.

Catastrophizing was assessed using the catastrophizing subscale of the Coping Strategies Questionnaire (CSQ), which measures patients' use of catastrophizing strategies to cope with pain [38]. For this six-item questionnaire, the range of values is 6–42, with greater scores corresponding to greater levels of catastrophizing.

Depression was assessed through the Beck Depression Inventory (BDI-II) [39]. In this 21-item questionnaire, scores between 0 and 13 correspond to the absence or minimal degree of depression, 14–19 to mild depression, 20–28 to moderate depression, and 29–63 to severe depression.

Anger was assessed using the scale for trait anger included in State Trait Anger Expression Inventory 2 (STAXI-2), which measures disposition toward anger as a personality trait [40]. For this 10-item questionnaire, the range of values is 0–40, with greater scores corresponding to greater levels of anger.

### Analysis

Frequencies were used for categorical variables. For continuous ones, mean and standard deviation or medians and interquartile range were used depending on whether data were normally distributed.

Simple correlations between the scores of the different scales were obtained through Spearman's correlation coefficient.

A linear regression model was developed to assess the association between disability and the other demographic, clinical, and psychological variables. Disability was the dependent variable, and the maximal model included the variables, which were statistically significant on univariate analysis, as well as a list of variables, which were selected at the design phase based on clinical criteria. These were ratings for LBP, RP, disability, trait anxiety, state anxiety, catastrophizing, depression, and anger, as well as gender, age, academic level (analyzed as "having reached high school or a higher level"), employment situation (analyzed as "receiving payment or compensation," employed, on

sick leave, or disabled), having undergone failed back surgery, and taking antidepressants.

The collinearity of the maximal model was evaluated using the criteria proposed by Belsley [42]. A backward elimination strategy was used, so that the variable with the highest  $P$  value not significant at the 0.05 level was excluded at each step, and the normality of residuals was assessed graphically and through the Kolmogorov–Smirnov test [43]. The goodness of fit was evaluated by the adjusted  $R^2$ . In order to assess the relative impact of each variable on the model, the standardized coefficients and changes in coefficient of determination ( $R^2$ ) were estimated. The order of the variables to assess the  $R^2$  change was determined by standardized coefficients.

The Statistical Package for the Social Sciences (SPSS) statistical package for Windows, version 17, was used for statistical analysis (SPSS Inc., Chicago, IL, USA).

### Results

One hundred sixty-two patients were screened for eligibility. Thirty-nine patients were excluded because they had left one or more questionnaires unanswered. The remaining 123 were included.

The characteristics of patients included in the study are shown in Tables 1 and 2. Most patients were employed (50.8%), married (78.5%), women (69.7%), and had completed elementary school (47.5%). Their mean age was 50.4 years and the median duration of pain was 730 days; only 12 (9.8%) had experienced pain for less than 6 months. All patients were on drug treatment. NSAIDs (61.0%) and non-narcotic analgesics (43.9%) were the most commonly used drugs, while 30.9% were using narcotics, 30.1% were using antiepileptic drugs, 27.6% were using antidepressants, and 20.3% were using muscle relaxants. Many were also receiving nonpharmacological procedures and 36 (29.3%) had undergone failed back surgery (Table 1). Despite these treatments, patients were suffering from a medium degree of LBP, referred pain, disability, anxiety (trait and state), depression, anger, and catastrophizing (Table 2).

Correlations between LBP, referred pain, disability, anxiety (trait and state), depression, anger, and catastrophizing are shown in Table 3. Correlations between anger and pain (both LBP and RP) were not significant. Correlations between all other variables were significant at the  $P < 0.001$  level. From stronger to weaker, disability correlated with STAI-T ( $r = 0.56$ ), BDI ( $r = 0.54$ ), CSQ ( $r = 0.53$ ), STAI-S ( $r = 0.50$ ), LBP intensity ( $r = 0.47$ ), RP ( $r = 0.43$ ), and STAXI-2 ( $r = 0.35$ ).

Among psychological variables, the strongest correlations were observed between STAI-T and STAI-S ( $r = 0.72$ ), STAI-T and BDI ( $r = 0.69$ ), and STAI-T and CSQ ( $r = 0.68$ ).

In the multivariate regression model, only age showed collinearity problems, which disappeared when it was cen-

## Low Back Pain, Disability, Anxiety, Depression, Catastrophizing, Anger

**Table 1** Characteristics of study participants (N = 123)

Variables	N	Value
Age (years)*	122	50.4 (13.5)
Sex (males)†	37	30.3
Academic level†		
Less than elementary school	15	12.2
Elementary school	57	46.3
High school	27	22.0
University	21	17.1
Unknown	3	2.4
Family status†		
Married	95	77.2
Single	17	13.8
Widowed	3	2.4
Divorced	6	4.9
Unknown	2	1.6
Work status†		
Employed or on sick leave	61	49.6
Retired + unemployed	27	22.0
Housewife + student + others	32	26.0
Unknown	3	2.4
Duration of pain (days)‡	123	730 (3,652,040)
Diagnosis†		
Common LBP	87	70.7
Failed back surgery	36	29.3
Drug treatment†		
NSAIDs	75	61.0
Analgesics (non opiates)	54	43.9
Opiates	38	30.9
Steroids	0	0.0
Muscle relaxants	25	20.3
Antidepressants	34	27.6
Antiepileptics	37	30.1
Other treatment†		
Passive physiotherapy	26	21.1
Active physiotherapy	48	39.0
Health education	16	13.0
TENS	15	12.2
Facet joint denervation	8	6.5
Trigger point injections	10	8.1
Facet injections	3	2.4
Epidural injections	33	26.8
Spine electrical stimulation	11	8.9
Other procedures	8	5.5

\* Mean (standard deviation); † Frequency (%); ‡ Median (interquartile range).

NSAID = nonsteroidal anti-inflammatory drug; TENS = transcutaneous electrical stimulation.

tered by subtracting its mean. Before centering age, the condition index and variance proportion were 32.42 and 0.69. After centering, these values were 24.15 and 0.03, respectively. Normality of residuals was assessed both graphically and statistically, and was satisfactory (mean of residuals was equal to  $1.5 \times 10^{-15}$ ). The only variables, which remained in the final model, were “STAI-T,” “LBP

intensity,” “having undergone failed back surgery,” and “academic level.” Trait anxiety and LBP intensity jointly explained 41% of the variability of disability. Failed back surgery explained an additional 6% of variability and academic level an additional 2% (Table 4). The standardized coefficients were 0.45 for STAI, 0.36 for LBP intensity, 0.25 for failed back surgery, and  $-0.14$  for having a higher academic level.

## Discussion

These results show that among Spanish chronic LBP patients treated in pain units, all the correlations between LBP, referred pain, disability, catastrophizing, anger, state anxiety, trait anxiety, and depression are significant, except for the ones between anger and LBP and between anger and referred pain. However, the multivariate regression model showed that the association of the other psychological variables with disability ceases to be significant when variations of trait anxiety are taken into account. Trait anxiety, severity of LBP, failed back surgery, and higher academic level were the variables contributing to explain the variance of disability.

Results from this study are consistent with current theoretical models. On the one hand, pain and disability are strongly linked [12–20], and it has been shown that patients with higher levels of trait anxiety perceive pain to be more intense [44,45]. On the other hand, anxiety trait is linked to anxiety sensitivity and, according to the fear-avoidance model of disability, an increase in anxiety sensitivity would worsen fear and avoidance, resulting in increased disability [30,46,47]. As a result, one might expect anxiety to correlate with disability which, in fact, was the strongest correlation found in this study. In addition, there is an overlap among psychological variables [48], and anxiety trait shows the strongest correlation with

**Table 2** Disability, pain, anxiety, depression, anger, and catastrophizing in study participants

Variable	Value*
Disability, RMQ	12.4 (5.7)
Low back pain, VAS	6.1 (2.4)
Referred pain, VAS†	6.0 (2.4)
State anxiety, STAI-S	31.0 (13.1)
Trait anxiety, STAI-T	32.3 (10.9)
Depression, BDI_II	23.2 (13.2)
Anger, STAXI-2	20.6 (6.9)
Catastrophizing, CSQ	22.3 (8.8)

\* Mean (SD). † Only for subjects who presented referred pain (N = 112).

RMQ = Roland–Morris Questionnaire; STAI-S = State Trait Anxiety Inventory-state; STAI-T = State Trait Anxiety Inventory-trait subscale; VAS = visual analog scale; BDI = Beck Depression Inventory; STAXI = State Trait Anger Expression Inventory; CSQ = Coping Strategies Questionnaire.

**Table 3** Spearman correlation coefficients between pain, disability, anxiety, depression, anger, and catastrophizing: Data from 123 patients

	Pain LBP VAS	Pain RP VAS	State Anxiety STAI-S	Trait Anxiety STAI-T	Depression BDI_II_	Anger STAXI-2	Catastrophizing CSQ
Disability, RMQ	<b>0.47</b>	<b>0.43</b>	<b>0.50</b>	<b>0.56</b>	<b>0.54</b>	<b>0.35</b>	<b>0.53</b>
Pain, LBP VAS		<b>0.70</b>	<b>0.36</b>	<b>0.26</b>	<b>0.34</b>	0.16	<b>0.39</b>
Pain, RP VAS			<b>0.36</b>	<b>0.35</b>	<b>0.41</b>	0.13	<b>0.48</b>
State anxiety, STAI-S				<b>0.72</b>	<b>0.55</b>	<b>0.55</b>	<b>0.67</b>
Trait anxiety, STAI-T					<b>0.69</b>	<b>0.57</b>	<b>0.68</b>
Depression, BDI_II						<b>0.48</b>	<b>0.58</b>
Anger, STAXI-2							<b>0.52</b>
Catastrophizing, CSQ							

All values in bold were significant at  $<0.001$  level. Value range: RMQ: 0–24. VAS: 0–10. STAI (both STAI-T and STAI-S): 0–60. BDI: 0–63. STAXI-2: 0–40. CSQ: 6–42.

LBP = low back pain; VAS = visual analog scale; RP = referred pain; STAI-S = State Trait Anxiety Inventory-state; STAI-T = State Trait Anxiety Inventory-trait subscale; BDI = Beck Depression Inventory; STAXI = State Trait Anger Expression Inventory; CSQ = Coping Strategies Questionnaire; RMQ = Roland–Morris Questionnaire.

the others, probably because it is the one that best reflects the subject's general psychological functioning. These findings might be interpreted as suggesting that the patient's general psychological state influences LBP-related disability to a higher degree than any individual psychological variable, such as catastrophizing, anger, or depression.

At the design phase, it was decided to identify the patients with failed back surgery because it was hypothesized that they might have a greater degree of disability, due to both physical and psychological reasons, after having unsuccessfully undergone an aggressive, invasive, and potentially dangerous treatment. In fact, results from the linear regression model showed that having undergone failed back surgery increases disability independently of the influence of psychological variables (Table 4). These results might be seen as consistent with systematic reviews and evidence-based clinical guidelines suggesting that surgery should not be considered as a first-choice treatment option for common LBP [49–51]. However, these results only indicate an association between failed back surgery and disability, and not the direction of this association. For

instance, it might be argued that patients with higher degrees of disability may be more likely to undergo surgery.

A higher academic level was also associated with a slightly lower degree of disability (Table 4). This finding is consistent with those from previous reports [52], and was not influenced by any of the psychological variables, which were assessed in the current study. Previous studies have shown that subjects with lower academic levels are more likely to interpret pain as a "signal of harm," which is disabling, uncontrollable, and unrelated to emotional experience [53]. They also endorse more passive and maladaptive coping strategies, suggesting that these variables may mediate the influence of the academic level on disability [52].

Due to the cross-sectional design of this study, the fact that pain and trait anxiety are "associated" with disability does not necessarily mean that these variables are "causing" the disability. In fact, it is likely that pain, disability, and trait anxiety worsen each other, especially in chronic patients. Nevertheless, both biologically and psychologically, it makes more sense to assume that pain leads to disability

**Table 4** Linear regression model\*

	Coefficient (95% CI)	Standard coefficient	P value	R <sup>2</sup> change
STAI-T	0.24 (0.17, 0.31)	0.45	$<0.001$	0.30
LBP, VAS	0.86 (0.54, 1.19)	0.36	$<0.001$	0.11
Failed back surgery	3.19 (1.54, 4.83)	0.25	$<0.001$	0.06
Academic level ("high school" or higher)	-1.68 (-3.26, -0.09)	-0.14	0.039	0.02

\* The maximal model included ratings for LBP, RP, trait anxiety, state anxiety, catastrophizing, depression, and anger, as well as gender, age, academic level (having reached high school or a higher level), work situation (employed vs others), having undergone failed back surgery, and taking antidepressants.

$R^2 = 0.49$ .

CI = confidence interval; STAI-T = State Trait Anxiety Inventory-trait subscale; LBP = low back pain; VAS = visual analog scale.

## Low Back Pain, Disability, Anxiety, Depression, Catastrophizing, Anger

rather than the other way around [9,54]. Similarly, results from this study might be interpreted as suggesting that it is easier for more anxious patients to develop more chronic or severe disability, independently of the severity of pain.

All the variables identified in this study only explain 41% of the variance of disability. This suggests that other factors not assessed in this study may also play a relevant role in LBP-related disability. These factors may include social factors and psychological and biological variables, which were not assessed in this study, such as kinesiophobia, self-efficacy, or muscle changes associated with prolonged reduction of physical activity [8–13,17–19,46,53–61].

Results from this study differ from those obtained previously with Spanish LBP patients, in which the variance of disability explained by psychological variables (catastrophizing and FAB) was much lower than the one explained by pain severity (Table 4) [15,16,62–64]. Two reasons may account for this. First, this study only included chronic LBP patients who were treated in pain units for very long-lasting pain (Table 1), whereas previous studies included both acute and chronic patients treated in primary care and hospitals [15,16,62–64]. As it was hypothesized at the design phase, it is possible that psychological variables have a greater influence among the most chronic patients, which were those included in the current study. Second, previous studies with Spanish patients assessed the influence of catastrophizing or FAB [15,16,62–64] but overlooked anxiety trait.

In previous studies conducted in the Anglo-Saxon or Scandinavian cultural environments, catastrophizing had a major influence on disability [8,11,13,20,28,54,65]. However, in the current study, the association between catastrophizing and disability disappeared when anxiety trait was taken into account. This discrepancy might be due to the fact that very few previous studies assessed the influence of anxiety trait on LBP-related disability [66]. Another reason might be cultural differences between the studied populations. In fact, previous studies conducted in the Spanish cultural setting had already questioned the importance of the influence of catastrophizing on LBP-related disability [63,64], while differences in pain significance and consequences across cultural settings have been documented; for instance, a large study, conducted with over 46,000 subjects from 16 European countries, found that Spain is the country with the lowest prevalence of chronic pain (11%) but with the highest rate of depression among chronic pain patients (29%) [4]. Factors that may account for differences across cultural environments include differences in individual's values, beliefs, and lifestyles, and characteristics of the National Health Service and social benefit systems across countries. Most studies, which have assessed the influence of cultural environment on pain experience, have compared the weight of different psychological factors across different cultural or ethnic groups [67–72]. In general, no differences have been found with regard to reaction to pain provoked in experimental conditions [69,70], but differences across cultural or ethnic groups have been documented when emotions,

coping mechanisms, and beliefs were assessed in real-life conditions [67–72].

As previous studies had shown that among Spanish patients with LBP, the weight of all the psychological variables is different to the one found among Anglo-Saxon and Scandinavian patients [8–11,15,16,20,53,55,56,62–65], in this study, a stepwise backward method was used in order to avoid such pre-hoc assumptions. Based on the results from this study and the theoretical framework supporting them, anxiety could be entered as the first variable in future studies using hierarchical models.

The sample size in this study does not allow the introduction of product variables into the maximal regression model, in order to analyze variable interactions. Further studies should consider analyzing psychological variables (anxiety, depression, anger, catastrophizing) among chronic pain patients as a cluster of symptoms instead of as separate comorbidities [73,74], focus on the prognostic value of trait anxiety for developing chronic disability, and assess the effect of anxiety reduction on the evolution of LBP-related disability. Results from this study support the potential value of cognitive behavioral treatment, treatments focusing on reducing anxiety in general (not only anxiety deriving from pain), and treatments aimed at improving any kind of irrational thoughts, which increase anxiety (whether they are related to pain or not). For instance, treatments based on cognitive bias modification, which have shown to be effective for reducing anxiety trait, could be tested in patients with chronic pain [75]. Moreover, patients with high STAI-T scores could be screened for the presence of specific types of anxiety disorder, which are especially responsive to certain medical treatments. In these patients, the use of such treatments in addition to cognitive behavioral therapy might improve results. Further studies should assess this hypothesis.

This study was conducted in pain units from nine hospitals belonging to the Spanish National Health Service, located in eight cities across Spain. The Spanish National Health Service is a public organization in which all health care services are provided free to every resident in Spain, and all patients included in this study were born and raised in Spain. These features suggest that these results are generalizable to LBP patients treated in pain units in the Spanish cultural environment. Further studies should study generalizability of these results to other cultural environments, to acute or subacute patients, to those treated in other levels of care, and to those with other kinds of chronic pain, such as fibromyalgia.

In conclusion, these results show that the correlation of catastrophizing, state anxiety, anger, and depression with disability ceases to be significant when variations of trait anxiety are taken into account. Further studies with LBP patients should determine whether anxiety trait mediates the effects of the other variables, explore its prognostic value, and assess the therapeutic effect of reducing it.

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## Low Back Pain, Disability, Anxiety, Depression, Catastrophizing, Anger

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**Moix et al.**

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