

**The role of pain-related cognitions in the relationship between pain severity,  
depression, and pain interference in a sample of primary care patients with both  
chronic pain and depression**

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**CITATION:** Sánchez-Rodríguez E, Aragonès E, Jensen MP, Tomé-Pires C, Rambla C, López-Cortacans G, Miró J. The Role of Pain-Related Cognitions in the Relationship Between Pain Severity, Depression, and Pain Interference in a Sample of Primary Care Patients with Both Chronic Pain and Depression. *Pain Med.* 2020 Oct 1;21(10):2200-2211. doi: 10.1093/pm/pnz363. PMID: 32100028.

**ABSTRACT**

**Objective:** The aims of this study were twofold: (1) to better understand the associations between pain-related cognitions and pain severity, and psychological and physical function, and (2) to determine the extent to which these cognitions function as mediators in the association between pain severity and depression in a sample of primary care adult patients with chronic pain and depression.

**Design:** Cross-sectional design

**Methods:** Three hundred and twenty-eight patients with both depression and chronic pain from primary care centers responded to measures of pain severity, pain interference, depression severity, and pain-related cognitions (including measures of catastrophizing and other pain-related beliefs). We performed three hierarchical regression analyses and two multiple regression analyses.

**Results:** The helplessness domain of pain catastrophizing was positively associated with pain severity, depression severity and pain interference, and mediated the relationship between depression and pain severity and *vice versa*. Beliefs about disability showed a positive association with pain severity, pain interference and depression severity, and also mediated the relationship between pain severity and depression. Believing in a medical cure was positively associated with pain interference and negatively with depression; emotion beliefs were positively associated with pain severity.

**Conclusions:** the findings provide important new information about the associations between several pain-related cognitions and pain severity, depression and pain interference and the potential mediating roles that these cognitions play in the

associations between pain severity and depression in patients with both chronic pain and depression in the primary care setting.

**Key words:** Chronic pain; Depression; Pain beliefs; Pain Catastrophizing; Pain Interference; Primary care.

ACCEPTED MANUSCRIPT

## INTRODUCTION

Both chronic pain and depression are among the most common conditions seen in patients presenting to primary care physicians (1). Moreover, both conditions are very costly; addressing them requires significant resources, especially when they co-occur (2–4). The prevalence of chronic pain among adults in the primary care setting has been estimated to be between 10% and 15% (5), and the prevalence of depression in primary care has been estimated to be about 14% (6–8). Furthermore, although there is a wide range of prevalence estimates for depressive symptoms in chronic pain populations (ranging from 4% to 94% (9)), most estimates are between 30% and 50% (10–14). These rates are much higher than the prevalence rates of depression in the general population (which average about 4%; (15,16)).

A number of investigators have sought to increase our understanding regarding the relationship between pain and depression (e.g., (17,18)). The current consensus is that there is a bidirectional relationship between pain and depression – an increase in one tends to result in an increase in the other – due to the facts that they [1] share a number of underlying neurobiology structures and neurotransmitters (e.g., serotonin, GABA) and [2] are likely influenced by the same psychosocial factors (e.g., locus of control, fear, catastrophic beliefs) (17).

In support of this idea, a number of studies have found that the relationship between pain and depression are mediated by psychosocial and cognitive factors such as catastrophizing, pain-related self-efficacy beliefs, and perceived social support (19–23).

However, although the associations between pain, depression and catastrophizing have been well studied (17,19,24), the mediating role that other pain-related beliefs may have on the association between pain and depression has not been as well-studied, especially in the primary care setting. Knowledge about the role that pain-related cognitions (in addition to catastrophizing cognitions) play in function in primary care patients is important, because such knowledge would be helpful in identifying the cognitions that might be important to target when treating chronic pain and depression in these patients.

Catastrophizing thoughts can be conceptualized as a set of pain-related beliefs (e.g., (25), as a type of coping response (e.g.,(26), or even as something distinct from beliefs or coping (e.g., (27); see also (28,29)). Regardless of whether catastrophizing is viewed as a type of belief or coping strategy, catastrophizing is clearly a cognitive response (29). Other pain-related cognitions are beliefs about pain that are generally classified as being adaptive or maladaptive, based on their associations with outcome variables. For example, the most commonly used measure of pain beliefs in pain research – the Survey of Pain Attitudes (SOPA) – assesses seven different specific pain-related beliefs. Of these, a belief in one’s ability to control pain has been shown to be positively related with better physical and psychological function (30–32), and is therefore viewed as an adaptive pain belief. On the other hand the beliefs that emotions influence pain, that solicitous responses are appropriate when somebody has pain, that medications are appropriate for the management of chronic pain, that a medical cure exists for pain, that one is necessarily disabled by pain, and that pain is a signal of damage and activity should be avoided, have been generally shown to be associated

with worse physical and psychological function (27,30–34). These latter beliefs are therefore generally classified as maladaptive pain-related beliefs.

The aims of the analyses presented here are to: [1] better understand the associations between a variety of pain-related cognitions and pain severity and patient psychological and physical function (i.e., depression severity and pain-related interference) and [2] determine the extent to which different pain-related cognitions function as mediators in the association between pain severity and depression, in a sample of adults with both chronic pain and depression in the primary care setting. Based on previous research, we hypothesized that pain-related cognitions thought to be adaptive (e.g., the belief that one has control over pain) will evidence independent and negative associations with measures of pain severity, depressive symptoms and pain interference. On the other hand, we hypothesized that pain-related cognitions thought to be maladaptive (e.g., the belief that one is necessarily disabled by pain) would show the opposite pattern. Furthermore, we hypothesized that both depression and pain would explain a significant part of the variance of the other, and that pain cognitions (including but not necessarily limited to catastrophizing) would mediate these associations.

## **METHODS**

### **Participants**

The data used in this study are baseline data that came from a clinical trial to evaluate the efficacy of a multicomponent program for the management of pain and depression in primary care (35). Participants were patients from eight primary care centers in the province of Tarragona, Catalonia, and were included in the trial if they met the following inclusion criteria: [1] being between 18 and 80 years; [2] having a musculoskeletal pain problem ranging from moderate to severe intensity (i.e., an average pain severity  $\geq 5$  on the Brief Pain Inventory [BPI]) lasting at least three months; [3] being able to understand and communicate in Spanish or Catalan (the two languages used to provide treatment); and [4] having a current diagnosis of Major Depressive Disorder (using DSM-IV-TR criteria). Participants were excluded from the study if they met the following exclusion criteria: [1] having any physical or psychological issue that would limit their ability to participate in the study; [2] having evidence for an alcohol or drug dependence disorder; [3] being pregnant or breastfeeding; [4] having a diagnosis of fibromyalgia or a somatization disorder; [5] seeking or being in the process of obtaining work-related disability leave; or [6] being scheduled for or planning a surgery for pain, including a joint prosthesis replacement surgery, in the next 12 months.

### **Procedure**

The study was approved by the Research Ethics Committee of the Primary Care Research Institute Jordi Gol (IDIAP; ref: P14/142). The procedure used to recruit the

sample has been described in another publication (35,36). This study used only baseline data obtained from participants recruited for that study, which had not been used previously.

## Measures

*Sociodemographic data.* All participants provided information about their sex, age, marital status, education status, employment status, and current occupation.

*Depression severity.* The study participants were asked to complete the Spanish version of the 20-item version of the Hopkins Symptom Checklist (HSCL-20; (37,38)). The HSCL-20 contains a list of frequent problems in people with depression, and respondents rate the degree to which each problem has concerned or bothered them in the last two weeks using a 5-point Likert scale from 0 “*Not at all*” to 4 “*Extremely*.” A total score is calculated by averaging the 20 items responses. Higher scores on the HSCL-20 indicate higher severity of depression. The internal consistency (Cronbach’s alpha) of the HSCL-20 total score in our sample was good ( $\alpha = .86$ ).

*Pain severity and pain interference.* Pain severity and pain interference were assessed using the Spanish version of the Brief Pain Inventory (BPI; (39,40)). The BPI includes four 0-10 Numerical Rating Scales, with which the respondent is asked to rate his or her current pain and worst, least and average pain in the last week, with 0 = “*No pain*” and 10 = “*The worst pain imaginable*.” As is commonly done, we computed an overall score of pain severity by averaging the four BPI pain intensity items (41–43). The BPI also includes seven items that ask respondents to rate the extent to which pain has

interfered with different daily life activities (i.e., general activity, mood, walking ability, normal work, relations with other people, sleep and enjoyment of life) in the last 7 days, using a 0 (“Does not interfere”) to 10 (“Completely interferes”) Numerical Rating Scale. As it is also commonly done, we computed an overall score of pain interference by averaging the seven BPI pain interference items (44). The Spanish version of the BPI has shown to provide valid and reliable data when used in non-cancer-related pain patients (40). The internal consistency of both pain severity and pain interferences scales of the BPI in our sample were good ( $\alpha$ s = .82 and .81, respectively).

*Pain catastrophizing.* Pain catastrophizing was assessed using the Spanish version of the 13-item Pain Catastrophizing Scale (PCS; (45,46)). Respondents are asked to rate the frequency that they have each of the 13 pain catastrophizing responses when they have pain using a 5-point Likert scale from 0 (“Not at all”) to 4 (“All the time”). The PCS can be used to assess three different domains of catastrophizing (i.e., magnification, rumination and helplessness) although it is usually scored as a total catastrophizing score that can range from 0 to 52. The Spanish version of the PCS has shown to provide valid and reliable data in different samples (46–48). The internal consistency (Cronbach’s alpha) of the PCS total score in our sample was excellent ( $\alpha$  = .93), whereas rumination, helplessness and magnification subscales showed a good internal consistency ( $\alpha$  = .89 and .87 and .79, respectively).

*Pain beliefs.* Pain-related beliefs were assessed using a Spanish brief (35-item) version of the Survey of Pain Attitudes (SOPA-35; (49)). With this measure, respondents rate how true or untrue each belief statement is for them using a 5-point Likert scale from

0 (“*This is very untrue for me*”) to 4 (“*This is very true for me*”). The items are then scored into seven different domains: Medical Cure (the extent to which the patient believes in a medical cure for his or her pain), Medication (the extent to which the patient believes that medication is an appropriate treatment for his or her pain), Disability (the extent to which the patient believes that one is unable to function because of pain), Emotion (the extent to which the patient believes that his or her emotions impact his or her pain), Solicitousness (the extent to which the patient believes that others should be solicitous in response to his or her experience of pain), Control (the extent to which the patient believes he or she can control the pain), and Harm (the extent to which the patient believes that pain means damage and therefore activity would be restricted). In this study we considered beliefs about control as adaptive beliefs and beliefs about a medical cure, medication, disability, solicitousness, and harm as maladaptive, consistent with how they were classified by the SOPA’s authors (50). The belief that emotions can impact pain is classified as an adaptive belief by the SOPA’s authors (50). However, most research has found that greater endorsement of this belief is associated with worse psychological function and greater pain interference (30–34). Thus, for the purpose of this study, we will consider this belief as maladaptive, and hypothesize that it will be positively associated with pain severity, depressive symptoms, and pain interference. The Spanish version of the SOPA-35 has shown to provide valid and reliable data in population with fibromyalgia (51). Cronbach’s alpha of the SOPA-35 scales in our sample ranged from .62 to .85. Thus, four scales (Emotion, Harm, Medical Cure and Disability) had marginal internal consistencies ( $\alpha = .62, .63, .64$  and  $.69$ , respectively), two scales (Disability and Control) had adequate (i.e., .70 to .79) internal consistencies ( $\alpha = .72$  and  $.75$ , respectively), and

one scale (Solicitude) had good (i.e., .80 to .89) internal consistency ( $\alpha = .85$ ) in the study sample.

### **Data analysis**

We first computed means and standard deviations (for continuous variables), numbers and percentages (for dichotomous variables) in order to describe the study sample and the study variables. Next, we examined their distribution (skewness and kurtosis) and multicollinearity (by computing variance inflation factors associated with each predictor) in order to ensure that the study variables met the assumptions for the planned analyses. We then performed three hierarchical regression analyses to test the associations between pain cognitions (including the three domains of the Pain Catastrophizing Scale: Rumination, Magnification and Helplessness) and the criterion variables of pain severity, depression severity and pain interference. In step 1 we entered demographic variables (age and sex) as a block. In step 2, we entered pain severity (if the criterion variables were depression severity or pain interference) and depression (if the criterion variables were pain severity or pain interference) as additional control variables. In step 3, we entered the measures of pain beliefs and catastrophizing as a block. Finally, in order to test our second hypothesis, that is to determine whether pain beliefs and catastrophizing mediate the association between pain severity and depression, we performed a series of two multiple regression analyses using PROCESS macro, developed by Hayes (52), testing as potential mediators those beliefs found to be associated with pain severity and depression in the regression analyses, and adding age and sex as covariates if they were significantly associated with pain severity and depression in the regression analyses.

## RESULTS

### Descriptive data of the study sample and variables

The sample was composed of 328 participants with an average age of 60.35 years (SD= 10.17). Two hundred and seventy-two were women (83%) and more than half of the sample had a primary education or less (N= 214; 65%). See Table 1 for additional descriptive data regarding the study sample.

[Insert Table 1 approximately here]

Descriptive statistics for the study variables are presented in Table 2. Results showed that all the variables were normally distributed (skewness= -.52 to .51 and kurtosis= -1.32 to .15) and that multicollinearity is not a problem in our sample (all the VIFs were lower than 10).

[Insert Table 2 approximately here]

### Regression analyses explaining pain severity

Regression analysis explaining pain severity showed that age and sex did not explain any variance in pain severity ( $R^2 = .00$ ,  $p = .393$ ) and that depression severity explained a significant 5% of the variance in pain severity in step 2. In step 3, after controlling for age, sex and depression severity, pain beliefs explained an additional and significant 19% of the pain severity's variance, due mostly to the effect of the PCS Helplessness scale ( $\beta = .33$ ,  $p < .001$ ), beliefs about disability ( $\beta = .14$ ,  $p = .049$ ), beliefs in pain as a

sign of harm ( $\beta = .19, p < .001$ ) and beliefs about emotions influencing pain ( $\beta = .20, p < .001$ ). All of these associations were in the direction predicted. In this last step, depression severity became non-significant (see Table 3).

[Insert Table 3 approximately here]

### **Regression analyses explaining depression severity**

Regression analysis explaining depression severity showed that age and sex explained a significant 9% of the variance of depression severity due mainly to the effects of age ( $\beta = -.21, p < .001$ ). Pain severity explained an additional and significant 4% of the variance in depression severity in step 2. In step 3, pain beliefs explained an additional 22% of the variance in depression severity, after controlling for age, sex and pain severity, due mainly to the effects of the PCS Helplessness scale ( $\beta = .24, p = .006$ ), beliefs about disability ( $\beta = .22, p < .001$ ) and beliefs in a medical cure for the pain problems ( $\beta = -.10, p = .042$ ). Furthermore, in step 3 pain severity became non-significant (see Table 4).

[Insert Table 4 approximately here]

### **Regression analyses explaining pain interference**

The results of the regression analysis explaining pain interference showed that age and sex explained a significant 5% of the variance of pain interference in step 1.

Furthermore, both pain severity and depression severity explained an additional 42% of the variance in pain interference in step 2 ( $\beta = .28$  and  $.30$  respectively, both  $ps$

<.001). In step 3, after controlling for sociodemographic data and pain and depression severity, pain beliefs still explained a significant 9% of the variance of pain interference, due mainly to the effect of the PCS Helplessness scale ( $\beta = .22$ ,  $p = .002$ ), the belief in oneself as disabled ( $\beta = .16$ ,  $p = .004$ ) and a belief in a medical cure ( $\beta = .10$ ,  $p = .008$ ; see Table 5).

[Insert Table 5 approximately here]

### **Mediation analyses**

In order to evaluate the mediation effects of pain-related cognitions on the association between pain severity and depression severity we included as mediators only those beliefs that emerged as significant in the regression analyses. Thus, the first model tested the helplessness catastrophizing domain, beliefs about disability and beliefs in a medical cure for pain as mediators for the association between pain severity (predictor) and depression severity (criterion). We also added the variable age as a covariate. The second model evaluated the helplessness catastrophizing domain and beliefs about disability, harm and that emotions affects pain as mediators of the association between depression severity (predictor) and pain severity (criterion). See Figures 1 and 2.

In support of the first model, pain severity was found to be significantly associated with beliefs in oneself as disabled and pain helplessness (path a:  $\beta = .16$  and  $1.43$ , respectively, both  $ps < .001$ ) but not with beliefs in a medical cure for pain. In addition, beliefs about disability and pain helplessness (path b:  $\beta = .22$  and  $.03$ , respectively,  $ps <$

.001) but not beliefs in a medical cure for pain were significantly associated with depression severity. Furthermore, while the total effect of pain severity on depression severity was significant (path c:  $\beta = .09$ ,  $p < .001$ ), this effect (direct effect) became non-significant ( $\beta = .01$ ,  $p = .706$ ) when controlling for beliefs about oneself as disabled. Indirect effects were tested using the Bootstrapping method and the statistical significance of the mediating role of beliefs about disability ( $\beta = .04$ , 95% CI (confidence interval) = .0183 - .0541) and pain helplessness ( $\beta = .04$ , 95% CI = .0234 - .0669) were confirmed. Lastly, the covariate variable (i.e., age) was significantly associated with two of the mediators (i.e., beliefs about disability and pain helplessness) and the criterion variable (i.e., depression severity).

[Insert Figure 1 approximately here]

In support of the second model, depression was found to be significantly associated with all of the mediators (i.e., pain helplessness and beliefs about disability, harm and emotion). In addition, all the mediators except for the belief in oneself as disabled were significantly associated with pain severity. Figure 2 shows the effects of these associations. Furthermore, although the total effect of depression severity on pain severity was significant (path c:  $\beta = .53$ ,  $p < .001$ ), this effect (direct effect) became non-significant ( $\beta = .04$ ,  $p = .767$ ) when controlling for pain helplessness and beliefs about harm and emotion. Indirect effects were tested using the Bootstrapping method and the mediating roles of pain helplessness ( $\beta = .28$ , 95% CI = .1172 - .4560), beliefs about harm ( $\beta = .10$ , 95% CI = .0310 - .1776) and beliefs about the role of emotion on pain ( $\beta = .12$ , 95% CI = .0247 - .2355) were confirmed.

[Insert Figure 2 approximately here]

## DISCUSSION

The primary aim of this research was to better understand the role that pain-related cognitions play in explaining pain severity, depression severity and pain interference in a sample of patients with chronic pain and depression in the primary care setting. Our findings only partially supported the study's hypotheses. Inconsistent with the study hypotheses, an adaptive belief (that is, the belief that one has control over pain) was not significantly associated with better adjustment to chronic pain and depression in the sample. On the other hand, some (but not all) maladaptive cognitions were associated with adjustment to chronic pain.

### **Adaptive beliefs and adjustment to chronic pain**

We hypothesized that adaptive beliefs – here reflected by a measure of a belief in control over pain – would be significantly and negatively associated with pain severity, depression severity and pain interference. Our results did not support this hypothesis. Inconsistent with a large number of studies in other samples of individuals with chronic pain (27,33,53–60), beliefs about pain control did not evidence a significant association with pain severity, depression severity or pain interference. Although the finding that beliefs classified as maladaptive were more strongly associated with patient function in the current sample than the belief classified as adaptive is consistent with research in other samples of patients with chronic pain showing that maladaptive beliefs may be more important than adaptive ones (e.g., (61)), this finding must be considered with caution as only one adaptive belief was assessed in this study.

If a larger role for maladaptive beliefs than adaptive beliefs replicates in other samples (and with other adaptive beliefs evaluated), including and in particular in research that tests causal associations, this would suggest the possibility that better outcomes might be obtained with treatments that focus more on decreasing maladaptive beliefs than increasing adaptive ones. However, as noted above, our study included a measure of only one adaptive belief (i.e., a belief about pain control); additional research is needed to evaluate the role of additional potentially adaptive beliefs (e.g., hope about the future) in adjustment to chronic pain, including in individuals with chronic pain in primary care settings.

### **Maladaptive cognitions and adjustment to chronic pain**

#### *Pain catastrophizing*

Pain catastrophizing – specifically, a measure of the helplessness domain of pain catastrophizing – was significantly and positively associated with pain severity, depression severity and pain interference in our sample. It is interesting that only helplessness, but not the rumination or magnification catastrophizing domains showed this association. This result extends findings from previous research (46,62–66) to a new population, and underscores the important role that thoughts regarding feeling helpless about pain and its impact might play in explaining pain severity, depression severity and pain interference across patient populations, including those in primary care settings.

Consistent with our findings, some authors have found that total scores of pain catastrophizing did not directly mediate the relationship between pain and depression (22,23,67). Instead, these authors found that pain catastrophizing indirectly influenced depression via its relationship with helplessness (a specific component of catastrophizing). Therefore, as Hülsebusch and colleagues (67) suggested, and consistent with the transactional model of stress (68), it may not be pain catastrophizing itself that influences depression severity, but the more specific thoughts about the lack of availability of adaptive strategies to cope with pain that plays the most important role.

These results suggest that psychological treatments aimed at the reduction of pain catastrophizing (by teaching patients about strategies to cope with pain; e.g., coping skills training (69–71)) – and in particular reductions in catastrophizing thoughts regarding helplessness about the availability of adaptive coping responses – in primary care patients with both pain and depression could potentially be beneficial, at least to reduce pain severity, depression severity and pain interference. Research to evaluate the effects of treatments targeting catastrophizing beliefs would help to clarify the causal role that catastrophizing may have across all outcome variables in primary care patients with depression and chronic pain.

#### *Disability beliefs*

Consistent with previous research (53,54,56,58,59,63), beliefs about disability were significantly and positively associated with pain severity, depression severity, and pain interference in our primary care patient sample. Moreover, and also consistent with

the study hypothesis, the findings showed that the association between pain (predictor) and depression severity (criterion) is mediated by beliefs about oneself as disabled. On the other hand, and inconsistent with our hypothesis, pain beliefs about disability did not mediate the association between depression severity (predictor) and pain (criterion).

Given the consistency with which disability beliefs are linked to important outcomes in patients with chronic pain – including now in patients in primary care settings – as well as the evidence that emerged from the current analyses that such beliefs may mediate the association between pain and depression, the findings support the potential importance of developing treatments that target these beliefs in primary care patients presenting with chronic pain. The treatment currently viewed as the gold standard for altering maladaptive beliefs in individuals with chronic pain is cognitive behavioral therapy (CBT; (72,73)). However, this treatment is usually provided by psychologists who specialize in chronic pain treatment. As a result, even if such a treatment were found to result in significant improvements in primary care populations, limited access to the specialists trained in this treatment approach would limit the numbers of patients who could benefit. Thus, there is also a need for research to evaluate the potential beneficial effects of treatments that could alter these and other beliefs that could be provided by health care providers that these patients might have more access to, such as physical therapists and/or nurses (see additional discussion of this issue, below).

### *Medical cure beliefs*

As hypothesized, believing in a medical cure for pain was shown to be significantly and positively associated with pain interference. However, contrary to the study hypotheses, belief in a medical cure for pain was negatively associated with depression severity. These results suggest that believing in a medical cure for pain might be maladaptive with respect to physical function (i.e., leading individuals with chronic pain to perhaps be less active) but potentially adaptive with respect to psychological function (i.e., perhaps giving hope to individuals with chronic pain). Consistent with this possibility, the authors of the measure used to assess belief in a medical cure for pain have noted that the SOPA Medical Cure subscale assesses two different components: [1] the belief that a cure for pain is possible (which could potentially give some patients hope) and [2] the belief that health care professionals, and not patients, are responsible for reducing or curing the pain problem (which could result in patients being more passive and less likely to actively manage their pain, and then lead to poor outcomes, including pain interference (50)). Consistent with our findings, Tait and Chibnall (31) found that endorsing the belief in a medical cure was negatively associated with depression and affective distress (showing its potential adaptive value) in a sample of patients with chronic from a pain service located in a medical center. On the other hand, this positive association between medical cure beliefs and measures of psychological function are not always found (27,30).

As a group, these findings suggest the possibility that beliefs in a medical cure for pain may play an important role in patient function in some, but not all, populations. More research is needed to evaluate the role that beliefs in a medical cure for pain may be

adaptive with respect to positive psychological function, while at the same time may be maladaptive with respect to pain interference. Future researchers might consider measuring the two medical cure beliefs assessed by the SOPA Medical Cure scale (i.e., belief that a medical cure is possible and belief that it is the responsibility of health care providers and not the patient to manage chronic pain) separately, to determine if these play different roles as predictors of patient function. If so, then perhaps it would be important for health care providers to avoid telling patients that “your chronic pain problem will never be cured” (in order to avoid eliciting feelings of hopelessness) while at the same time telling patients that ultimately, and “until a cure for chronic pain is found,” it would be useful to learn some pain coping techniques in order to more effectively manage pain and its impact on function.

#### *Other beliefs*

As hypothesized, and in line with previous research (31,34,63), beliefs about the impact of emotions in pain showed to be significantly and positively associated with pain severity (54,63). Previous research is consistent with this finding, finding that such beliefs tend to be positively associated with worse psychological function and greater pain interference (30–34). Although beliefs that emotion can impact pain was originally thought to be adaptive, because such beliefs were thought to both be accurate and provide patients with a reason for managing the emotional impacts of pain (50), the empirical findings regarding this belief are fairly consistent, suggesting that beliefs about the impact of emotions in pain may be maladaptive. To the extent that future research finds these associations to be causal (causal conclusions cannot be made based on the current cross-sectional design, see the limitations section), they

would indicate that the common practice of teaching patients about the role of emotions on pain as part of CBT for chronic pain (e.g., (74,75)) may not be particularly useful. In fact, as suggested by Miró and colleagues (76), while it may not be that useful to be aware that emotions influence pain (and *vice versa*), it may be very useful to learn what to do to manage the impact of these emotions. However, the “Emotion scale” of the SOPA does not allow us to distinguish patients who have the skills needed to manage these pain-related emotions from those who do not have these skills. A new measure to assess this coping response, specifically, would be needed to help clarify this issue.

### **Theoretical and clinical implications**

The findings as a whole have a number of important theoretical and clinical implications. First, they highlight the importance of assessing a variety of beliefs as predictors of pain and function in individuals with chronic pain. A great deal of focus in both research and clinical practice has been on pain catastrophizing (e.g., (77,78)), pain self-efficacy (e.g., (79,80)), and perceived control over pain (e.g., (81–83)). However, patients can, and do, vary with respect to a large number of other beliefs about pain. The current findings underscore a conclusion that a number of these other beliefs – some, but not all, of which were assessed and evaluated in this study – are also important. A thorough theoretical understanding of pain should take these other beliefs into account.

Second, the findings suggest that the role of cognitions in explaining pain severity, depression severity and function, may differ in different pain populations. Thus, for

example, while catastrophizing is a fairly consistent predictor of pain and function across many patient samples (77,84–88) and even across many different cultures as represented by research from different parts of the world (84,89,90), catastrophizing is not always shown to be associated with pain severity, depression, or pain interference (91,92). Indeed, the total catastrophizing score was not found to be significantly associated with depression severity in the current sample, although the helplessness domain was. This means that it would be important to not only assess pain cognitions when performing evaluations of individuals with chronic pain, but to understand the role that such cognitions play in pain and function for the particular population of patient being evaluated, in order to develop and provide the most effective treatment program for that patient.

Finally, as alluded to earlier, to the extent that pain cognitions are important in explaining function in individuals seen in primary care settings, as suggested by the current findings, an important next step is to design and evaluate the potential beneficial effects of treatments that target these cognitions for change in this population, in order to evaluate their causal role on pain and function. However, it would be important to develop and then evaluate interventions that would ultimately be accessible to these patients. This suggests that future researchers should consider clinical trials of treatments that could be facilitated by health care providers who are most accessible to primary care patients; for example, nurses who work in primary care offices, or physical therapists to whom the primary care health care providers refer patients.

## Limitations

This study has a number of limitations that should be kept in mind when interpreting the results. Primary among these is the fact that this study used a cross-sectional design. As a result, it is not possible to draw causal conclusions from these findings. Future experimental research is needed to determine if the beliefs found to be associated with pain severity, depression severity and pain interference here have a causal influence on these function domains. Longitudinal studies that evaluate the temporal associations between changes in pain-related cognitions and subsequent changes in pain and function would allow us to more effectively evaluate the mediator roles of pain cognitions in the associations between pain and depression severity. Second, the sample was one of convenience, made up of individuals recruited from the electronic clinical records of patients with chronic musculoskeletal pain on the rosters of the participating physicians. Thus, the extent to which the findings would replicate in other samples of individuals with chronic musculoskeletal pain is not known. Thus, additional research in other samples is needed to establish the reliability and generalizability of the current findings. Finally, in this study only one adaptive belief was assessed (i.e. belief about controllability of pain). Further research studying the role of others adaptive beliefs (e.g. self-efficacy, hope) in adjustment to chronic pain, including in individuals with chronic pain in primary care settings are needed.

### **Summary and conclusions**

Despite the study's limitations, the findings provide important new information about the association of several pain-related cognitions with pain severity, depression severity and pain interference and the potential roles that these cognitions play as potential mediators of pain severity and depression severity in patients with both chronic pain and depression in the primary care setting. The findings also indicate that additional research is needed to confirm the mediation effects found; the findings from this research could then be used to inform the development of treatment programs designed to influence maladaptive pain-related cognitions in patients with both chronic pain and depression.

## ACKNOWLEDGEMENTS

Support for the study upon which the findings reported here are based was provided by Carlos III Health Institute of Spain's Ministry of the Economy and Competitiveness, under Health Strategy Action 2013-2016 [PI14/00573] and with co-funding from the European Regional Development Fund. EA received a grant for intensification of research activity from the Carlos III Institute [INT15/00232]. EA and GLC have benefitted from grants for intensification of research activity from the IDIAP Jordi Gol, and CR received a predoctoral grant from the IDIAP Jordi Gol [7Z16/008, 2015]. JM's work is supported by Obra Social de Caixabank, Universitat Rovira i Virgili (PFR Program), Spanish Ministry of Economy and Competitiveness (RTI2018-09870-B-I00; RED2018-102546-T), the *Institució Catalana de Recerca i Estudis Avançats* (ICREA-Acadèmia), and Fundación Grünenthal.

**Conflict of interest:** The authors declare no conflicts of interest in relation with this work.

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## Tables

**Table 1. Sociodemographic data**

	N	%
<b>Marital status</b>		
Single	15	5
Married / Partner	206	63
Divorced / Separated	52	16
Widow / Widower	51	15
Missing data	4	1
<b>Level of education</b>		
Without formal education	42	13
Primary school	172	52
Lower secondary school	48	15
Upper secondary school	48	15
University	14	4
Missing data	4	1

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**Table 2. Descriptors of the study variables**

	Mean (SD)	Range	Skewness	Kurtosis
BPI pain severity	6.52 (1.82)	0 – 10	-.26	.15
BPI pain interference	6.35 (2.31)	0 – 10	.37	-.65
HSCL-20	1.68 (.74)	.05 – 3.60	-.52	-.41
PCS Rumination	7.26 (5.29)	0 – 16	.26	-1.23
PCS Magnification	3.91 (3.40)	0 – 12	.70	-.49
PCS Helplessness	10.68 (6.72)	0 – 24	.21	-.92
PCS Total	21.84 (14.04)	0 – 52	.39	-.91
SOPA Control	2.15 (1.12)	0 – 4	-.26	-.99
SOPA Disability	1.41 (.92)	0 – 4	.51	-.70
SOPA Harm	1.94 (.82)	0 – 4	.34	-.41
SOPA Emotion	2.34 (1.10)	0 – 4	-.47	-.86
SOPA Medication	2.76 (.98)	0 – 4	-.50	-.62
SOPA Solicitude	1.58 (1.43)	0 – 4	.39	-1.32
SOPA Medical Cure	2.54 (1.03)	0 – 4	-.30	-.82

Note: BPI: Brief Pain Inventory; HSCL-20: Hopkins Symptoms Checklist, 20 items; PCS: Pain Catastrophizing Scale; SOPA: Survey of Pain Attitudes.

Highlighted p were significant at .05, .01 or .001.

**Table 3. Regression analysis explaining pain severity**

Step	Predictor	$R^2$	$R^2$ change	$F$	$\beta$	$t$	$p$	Tolerance	VIF
1	<b>Demographics</b>	.00	.00	.94			.393		
	Age				.11	1.95	.052	.809	1.24
	Sex				-.08	1.60	.111	.948	1.05
2	<b>Depression severity</b>	.05	.05	15.55			<b>&lt;.001</b>		
					.01	.09	.928	.645	1.55
3	<b>Pain-related cognitions</b>	.24	.19	7.87			<b>&lt;.001</b>		
	PCS Rumination				-.05	.54	.591	.339	2.95
	PCS Magnification				-.09	1.12	.262	.389	2.57
	PCS Helplessness				.33	3.65	<b>&lt;.001</b>	.291	3.43
	SOPA_Control				.03	.47	.640	.525	1.91
	SOPA_Disability				.14	1.98	<b>.049</b>	.468	2.14
	SOPA_Harm				.19	3.51	<b>&lt;.001</b>	.815	1.23
	SOPA_Emotion				.20	3.35	<b>&lt;.001</b>	.660	1.52
	SOPA_Medication				-.08	1.49	.138	.858	1.17
	SOPA_Solicitude				-.10	1.73	.085	.758	1.32
	SOPA_Medical Cure				.05	.90	.367	.921	1.09

Note: Depression severity was measured by the Hopkins Symptom Checklist, 20 items;

PCS: Pain Catastrophizing Scale; SOPA: Survey of Pain Attitudes.

Highlighted p were significant at .05, .01 or .001.

**Table 4. Regression analysis explaining depression severity**

Step	Predictor	$R^2$	$R^2$ change	$F$	$\beta$	$t$	$p$	Tolerance	VIF
1	<b>Demographics</b>	.09	.09	16.18			<b>&lt;.001</b>		
	Age				-.21	4.24	<b>&lt;.001</b>	.845	1.18
	Sex				-.09	1.87	.062	.951	1.05
2	<b>Pain severity</b>	.13	.04	15.55			<b>&lt;.001</b>		
					.01	.09	.928	.759	1.32
3	<b>Pain-related cognitions</b>	.35	.22	10.82			<b>&lt;.001</b>		
	PCS Rumination				-.05	.61	.544	.339	2.95
	PCS Magnification				-.05	.66	.512	.388	2.58
	PCS Helplessness				.24	2.79	<b>.006</b>	.286	3.49
	SOPA_Control				-.09	1.45	.149	.528	1.89
	SOPA_Disability				.22	3.38	<b>&lt;.001</b>	.479	2.09
	SOPA_Harm				.02	.31	.760	.785	1.27
	SOPA_Emotion				.09	1.58	.115	.642	1.56
	SOPA_Medication				.09	1.80	.074	.861	1.16
	SOPA_Solicitude				.05	.86	.389	.753	1.33
	SOPA_Medical Cure				-.10	2.04	<b>.042</b>	.930	1.08

Note: Pain severity was measured by the Brief Pain Inventory; PCS: Pain Catastrophizing Scale; SOPA: Survey of Pain Attitudes.

Highlighted p were significant at .05, .01 or .001.

**Table 5. Regression analysis explaining pain interference**

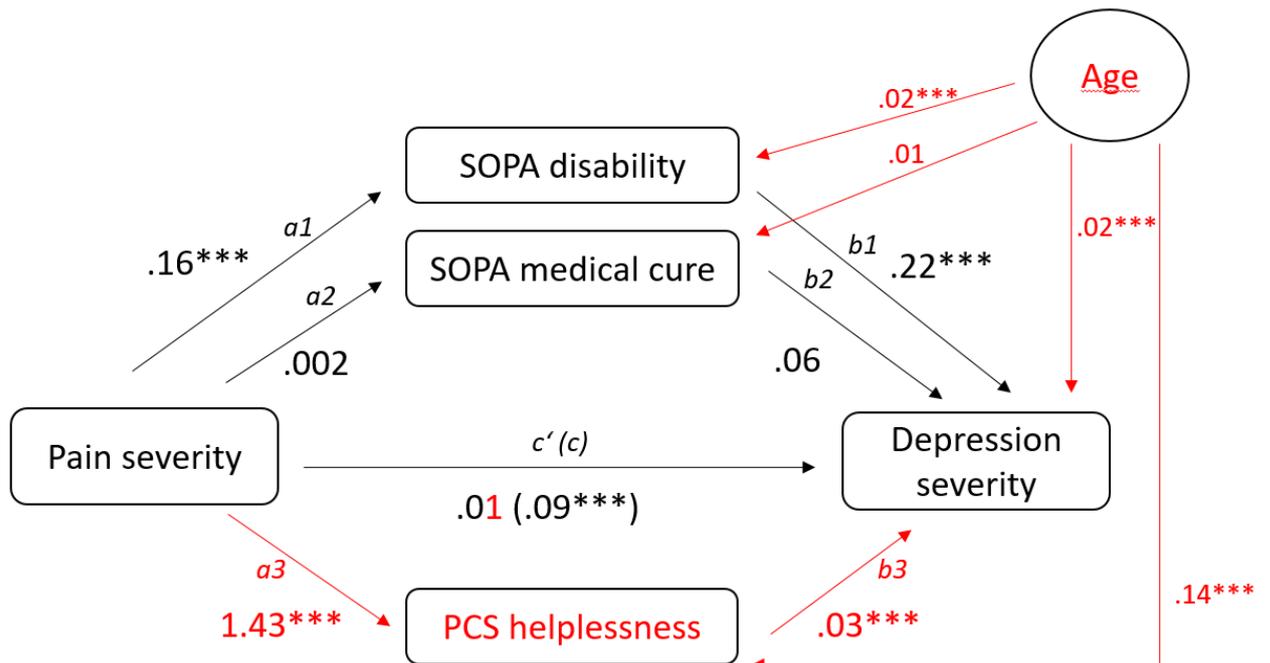
Step	Predictor	$R^2$	$R^2$ <i>change</i>	$F$	$\beta$	$t$	$p$	Tolerance	VIF
1	<b>Demographics</b>	.05	.05	8.61			<b>&lt;.001</b>		
	Age				-.03	.74	.463	.799	1.25
	Sex				-.04	.96	.339	.940	1.06
2	<b>Control variables</b>	.47	.42	130.10			<b>&lt;.001</b>		
	Pain severity				.28	6.59	<b>&lt;.001</b>	.759	1.32
	Depression severity				.30	6.53	<b>&lt;.001</b>	.645	1.55
3	<b>Pain-related cognitions</b>	.57	.09	6.72			<b>&lt;.001</b>		
	PCS Rumination				.02	.30	.769	.338	2.96
	PCS Magnification				.01	.17	.867	.387	2.58
	PCS Helplessness				.22	3.06	<b>.002</b>	.279	3.58
	SOPA_Control				.03	.52	.604	.524	1.91
	SOPA_Disability				.16	2.89	<b>.004</b>	.462	2.16
	SOPA_Harm				.05	1.13	.259	.785	1.28
	SOPA_Emotion				.01	.24	.810	.637	1.57
	SOPA_Medication				.06	1.37	.173	.852	1.17
	SOPA_Solicitude				.02	.46	.645	.751	1.33
	SOPA_Medical Cure				.10	2.67	<b>.008</b>	.918	1.09

Note: Pain severity was measured by the Brief Pain Inventory; Depression severity was measured by the Hopkins Symptom Checklist, 20 items PCS: Pain Catastrophizing Scale; SOPA: Survey of Pain Attitudes.

Highlighted p were significant at .05, .01 or .001.

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Figure 1. Mediation analyses predicting depression severity.

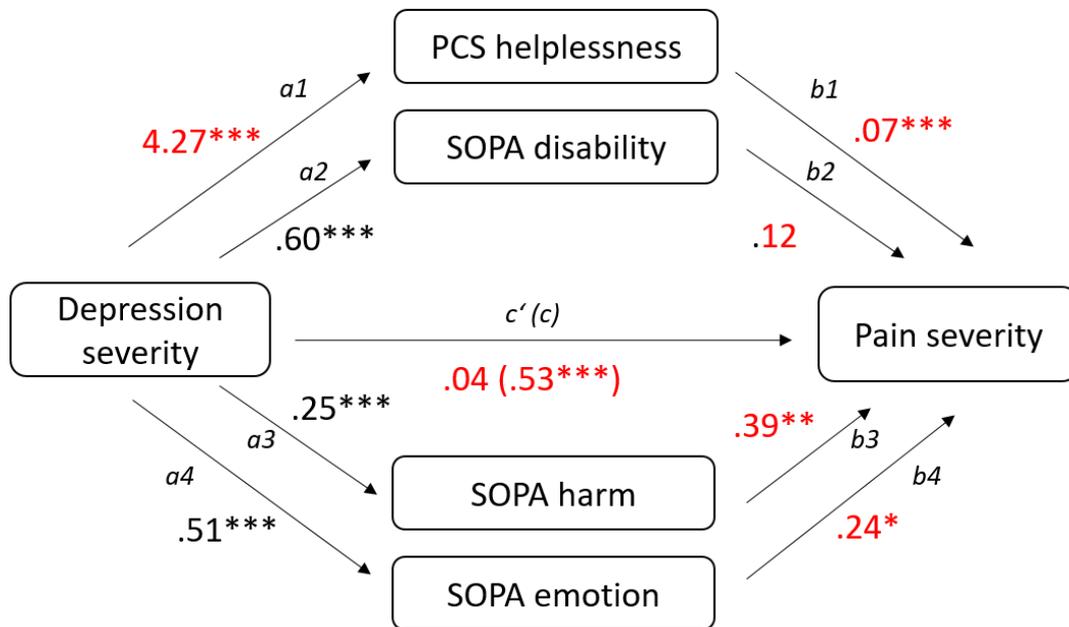


SOPA= Survey of Pain Attitudes

PCS = Pain Catastrophizing Scale

Note: \*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$

Figure 2. Mediation analyses predicting pain severity.



SOPA= Survey of Pain Attitudes

PCS = Pain Catastrophizing Scale

Note: \*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$