Pain catastrophizing, activity engagement and pain willingness as predictors of the benefits of multidisciplinary cognitive behaviorally-based chronic pain treatment

Jordi Miró, PhD, [a,b,c] Elena Castarlenas, PhD, [a,b,c] Rocío de la Vega, PhD, [a,e] Santiago Galán, MSc, [a,b,c] Elisabet Sánchez-Rodríguez, PhD, [a,b,c] Mark P. Jensen, PhD, [d] Douglas Cane, PhD, [e]

[a] Unit for the Study and Treatment of Pain – ALGOS, Universitat Rovira i Virgili, Catalonia, Spain
[b] Research Center for Behavior Assessment (CRAMC), Department of Psychology, Universitat Rovira i Virgili, Catalonia, Spain
[c] Institut d'Investigació Sanitària Pere Virgili; Universitat Rovira i Virgili, Catalonia, Spain
[d] Department of Rehabilitation Medicine, University of Washington, Seattle, WA, USA
[e] Pain Management Unit, Nova Scotia Health Authority, Halifax, NS, Canada

Correspondence:

Jordi Miró, Departament de Psicología,Universitat Rovira i Virgili, Carretera de Valls, s/n, 43007 Tarragona, Spain
jordi.miro@urv.cat

Disclosure/Conflict of interest information: The authors declare no financial or other relationships that might lead to a conflict of interest related to this study.

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

Running title: Pain Catastrophizing and Acceptance in pain treatment

CITATION: Miró J, Castarlenas E, de la Vega R, Galán S, Sánchez-Rodríguez E, Jensen MP, Cane D. Pain catastrophizing, activity engagement and pain willingness as predictors of the benefits of multidisciplinary cognitive behaviorally-based chronic pain treatment. J Behav Med. 2018 Dec;41(6):827-835. doi: 10.1007/s10865-018-9927-6. Epub 2018 May 7. PMID: 29736780.

ABSTRACT

Pain catastrophizing and pain acceptance have been shown to be associated with improvements after participation in cognitive behaviorally-based treatment (CBT) for chronic pain. However, it is not yet clear how important each of these factors is relative to the other. Furthermore, it is also not clear if multidisciplinary pain treatment has the same impact on the two primary dimensions of pain acceptance (activity engagement and pain willingness), and whether their role in explaining treatment outcome differs as a function of the outcomes under study.

The aim of this study was to examine the relative importance of changes in pain catastrophizing, activity engagement and pain willingness as predictors of the benefits of a multidisciplinary CBT for chronic pain.

186 adults with chronic pain participated. Pain catastrophizing and activity engagement, but not pain willingness, were significantly associated with treatment outcome. Moreover, each one evidenced different patterns of associations with outcomes. Specifically, while changes in both were associated with improvements in depressive symptoms, only catastrophizing was associated with improvements in pain intensity and only activity engagement was associated with improvements in pain-related disability.

Key words: pain catastrophizing; activity engagement; pain willingness; pain acceptance; chronic pain treatment.

INTRODUCTION

A large and growing body of evidence demonstrates that psychosocial treatments can improve patient function and overall adjustment to chronic pain

(Jensen & Turk, 2014). However, it remains unclear for whom and under what circumstances different treatments are most efficacious (Ehde, Dillworth, & Turner, 2014). In order to identify the best available options for patients with chronic pain, and inform the development of new and more effective treatments, it is important to understand the variables and processes that account for the positive effects of pain treatments (Cederberg, Cernvall, Dahl, von Essen, & Ljungman, 2016; Ehde et al., 2014).

Cognitive-behavioral therapy (CBT) is a psychosocial treatment that has been extensively used in the treatment of individuals with disabling chronic pain. It is not a single therapy but an intervention encompassing multiple components (Jensen, 2011), although almost all versions of CBT include cognitive restructuring, which attempts to reduce maladaptive and increase adaptive cognitions as a way to improve behavior and mood. With cognitive therapy, the objective is to teach patients identify their thoughts, evaluate them to determine if they are helpful or unhelpful, and replace any unhelpful thoughts with thoughts that are more beneficial.

Pain catastrophizing, which can be defined as a negative cognitive and affective pattern characterized by rumination, magnification, and helplessness towards pain (Sullivan, Bishop, & Pivik, 1995), is a key variable that has been hypothesized to explain the benefits of CBT and cognitive restructuring. In support of this idea, catastrophic thinking about pain has been found to be associated with increased pain intensity, pain interference and disability in different chronic pain samples (Huguet, Miró, & Nieto, 2008; Nieto, Miró, Huguet, & Saldaña, 2011; Racine et al., 2016). Moreover, some evidence, albeit limited, has shown that the effects of multidisciplinary CBT-based treatments for

individuals with chronic pain are mediated, at least in part, by the effects of treatment on catastrophizing. For example, Nieto and colleagues (Nieto, Raichle, Jensen, & Miró, 2012) have shown that pre- to post-multidisciplinary pain treatment decreases in catastrophizing are associated with pre- to post-treatment improvements in function, as defined by decreases on self-reported disability, depressive symptomatology, and pain intensity in a sample of individuals with neuromuscular dystrophy. Similarly, Burns and colleagues found that early treatment decreases in catastrophizing predicted later treatment improvements in pain severity and function (Burns, Glenn, Bruehl, Harden, & Lofland, 2003; Burns, Kubilus, Bruehl, Harden, & Lofland, 2003), but not *vice versa*.

Acceptance-based treatments, such as Acceptance and Commitment Therapy (ACT), is a form of CBT that focuses less on teaching patients to change the content of thoughts, and more on teaching patients to change their relationship to their thoughts (McCracken, 2005). In addition, ACT encourages patients to focus in increasing behaviors that are consistent with their values and goals, despite pain, rather than on strategies that will specifically reduce pain. This *pain acceptance approach* (i.e., engaging in activities related to goals and values, despite pain, and refraining from attempts at avoidance or control of pain), has also been reported to be associated with positive outcomes. For example, Vowles and colleagues (Vowles, McCracken, & Eccleston, 2007) reported that treatment-related increases in pain acceptance accounted for significant variance in treatment-related improvements in physical and psychological function.

Pain acceptance is not a unitary concept. At least, as measured by the most commonly used measure of this domain, the Chronic Pain Acceptance Questionnaire or CPAQ (McCracken, Vowles, & Eccleston, 2004); it has two components: activity engagement (i.e., being engaged in valued life activities despite pain) and pain willingness (i.e., a willingness to refrain from attempting to control pain).

Research has yet to determine if these two acceptance domains contribute equality to explaining treatment outcomes, as the majority of studies have used the CPAQ total score. We were only able to identify two studies that examined the subscales separately. In one, Day and Thorn (Day & Thorn, 2016) found in a sample of 24 patients completing a mindfulness-based program for headache that changes in activity engagement, but not pain willingness, was associated with improvements in pain interference after treatment. A second study only examined pain willingness (Richardson et al., 2010), and found that pain willingness had a stronger effect than catastrophizing with respect to pain interference during a laboratory-based pain task.

Based on these findings, it would be reasonable to hypothesize that pain catastrophizing and pain acceptance would make unique contributions to the prediction of improvements after chronic pain treatment. However, it is not yet clear how important each of the two components of pain acceptance are relative to the other, and whether the potential role of these three variables differ as a function of the outcomes under study.

Given these considerations, the aim of this work was to examine (1) the associations among pain catastrophizing, pain willingness, and activity

engagement, and (2) the importance of changes in pain catastrophizing, pain willingness, and activity engagement as predictors of the benefits of a multidisciplinary chronic pain CBT-based treatment. Based on previous research, we hypothesized that pain willingness and activity engagement would be positively correlated, whereas pain catastrophizing would be negatively correlated with pain willingness and activity engagement. We also hypothesized that pre- to post-treatment changes in pain catastrophizing would show a significant and positive univariate association with change depressive symptoms and pain interference, while changes in pain willingness and activity engagement would evidence significant negative associations with changes in both criterion variables. Finally, we hypothesized that treatment-related decreases in pain catastrophizing and increases in activity engagement would contribute unique variance to improvements (i.e., decreases) in pain intensity, pain interference, and depressive symptomatology in a sample of adults who completed a CBT multidisciplinary chronic pain program. Given that there is limited data with respect to the role of pain willingness has in pain treatment, we considered analyses to evaluate the associations between pain willingness and treatment outcome to be exploratory.

METHODS

Participants

Individuals for this study (N = 186) came from a group of adults living in Canada with chronic pain that were referred to and participated in a multidisciplinary cognitive-behavioral based chronic pain program. The average age of the participants was 50.30 years (SD = 11.17; range = 22 – 78) and the majority were women (64%). The majority reported that they were experiencing

pain at three or more pain sites (75%). Of those that reported pain in one site, the lower back was the most frequently reported site (13%). Participants tended to be married (64%) and well educated (58% reported having finished college or a university degree). Although a few of them were working either full- or part-time (12%), most were on disability compensation (46%). Additional descriptive information about this sample of participants is provided in Tables 1 and 2.

[Insert Table 1 about here]

Measures

Pain catastrophizing

We used the 13-item Pain Catastrophizing Scale (PCS; Sullivan et al., 1995) to assess pain catastrophic thinking. The PCS requires respondents to indicate the frequency with which they have catastrophic thoughts when they are in pain on a 0 ("*Not at all)*" to 4 ("*All the time*") scale. The PCS assesses three catastrophizing domains: rumination (i.e. *"I cannot keep it out of my mind")*, magnification (i.e. *"I am afraid that pain will get worse")* and helplessness (i.e. *"There is nothing I can do to reduce pain"*), although the subscale scores are strongly associated with one another and are usually combined into a single total catastrophizing score, as was done in the current analyses. Higher scores indicate more frequent catastrophic pain beliefs (scores can range from 0 to 52). The PCS has proved to provide reliable and valid reports when used in different chronic pain samples (Miró, Nieto, & Huguet, 2008; Van Damme, Crombez, Bijttebier, Goubert, & Van Houdenhove, 2002). In the current sample, the internal consistency coefficient (Cronbach's alpha = 0.94) indicated excellent reliability.

Activity engagement and Pain willingness

We used the revised 20-item version of the Chronic Pain Acceptance Questionnaire (CPAQ-R; (McCracken et al., 2004)) to measure the degree to which participating patients engaged in life activities regardless of present pain ("Activity Engagement") and their beliefs about the need to control pain (or refraining from avoidance; items assessing pain control are reverse scored to assess "Pain Willingness"). In the CPAQ-R, respondents are asked to rate how true each of the items is on a Likert scale from 0 ("*Never true*") to 6 ("*Always true*"). Higher scores indicate greater activity engagement and pain willingness. All of the Pain Willingness items assess a perceived need to control pain (e.g., "*My thoughts and feelings about pain must change before I can take important steps in my life*"). Therefore, they are reverse-scored to reflect a willingness to give up efforts to control pain or a recognition that it is not necessary to control pain in order to be active or achieved valued goals. The CPAQ-R has been shown to provide valid and reliable scores in different samples of patients and in different languages (Reneman, Dijkstra, Geertzen, & Dijkstra, 2010). In the current sample, the internal consistency coefficient (Cronbach's alpha) was good for the Activity Engagement scale (Cronbach's alpha = 0.85) and adequate for the Pain Willingness scale (Cronbach's alpha = 0.76).

Pain intensity

We used a 0 -10 Numerical Rating Scale (NRS-11) to measure pain intensity. The NRS-11 has been found to provide reliable and valid reports of pain intensity with adults experiencing chronic pain (Jensen & Karoly, 2011). Respondents were asked to rate their current, least and worst pain intensity in the past week by providing a number that best represented their pain intensity, between 0 ("*No pain*") to 10 ("*Worst pain imaginable*"). We combined these

three pain intensity scores into a single measure of “characteristic pain,” given that composite pain intensity scores have been shown to be more reliable than individual ratings (Jensen et al., 2015a, b; Stone, Schneider, Broderick, & Schwartz, 2014). To create the pre- to post-treatment characteristic pain change scores, we subtracted the post-treatment from the pre-treatment composite score; thus, a higher (positive) change score indicates a greater decrease in pre- to post-treatment characteristic pain, and negative scores indicate a pre- to post-treatment increase in characteristic pain. The internal consistency coefficient of this measure (Cronbach’s alpha = .72) was found to be acceptable in the current sample.

Pain Interference

We used the Pain Disability Index (PDI; Tait, Pollard, Margolis, Duckro, & Krause, 1987) to measure the degree to which the participants perceived that their daily lives were disrupted by chronic pain. This questionnaire includes 7 items related to different activity domains (Family/Home responsibilities; Recreation; Social activity; Occupation; Sexual behavior; Self-care; Life-support activity). Respondents are asked to indicate the level to which their pain prevents them from doing what they would normally do in these domains on a Likert scale from 0 (“*No disability*”) to 10 (“*Total disability*”). Higher scores indicate greater pain interference. The PDI has been shown to provide reliable and valid measures of pain interference in samples of individuals with chronic pain (Tait, Chibnall, & Krause, 1990). Change scores were computed such that positive scores indicate a decrease in perceived pain interference, whereas negative scores indicate an increase in pre- to post-treatment perceived pain

interference. In the current sample, the internal consistency coefficient of the PDI (Cronbach's alpha = 0.83) was found to be good.

Depressive symptoms

We used the Beck Depression Inventory (BDI) to assess depressive symptoms (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI scores have demonstrated excellent psychometric properties when used with chronic pain samples (Benzon et al., 2013). The internal consistency coefficient (Cronbach's alpha = 0.90) indicated excellent internal consistency reliability for this scale in the current sample. As with the other measures, change scores were computed, with positive scores indicating a pre- to post-treatment decrease in depressive symptoms and negative scores indicating an increase in pre- to post-treatment depressive symptoms.

Procedure

The treatment program comprised three group sessions per week of three hours of duration each. In these treatment sessions, participants (1) received education about the physiology of pain, sleep hygiene, and communication with others; (2) learnt to set relevant and realistic goals; and (3) were trained in relaxation, activity pacing and taught in management strategies. An interdisciplinary team comprised by psychologists, physiotherapists, and occupational therapists was responsible of the treatment program. Patients were expected to practice at home and to include the new skills in their daily routines. Inclusion criteria included: (a) having chronic pain and (b) a willingness to attend to the four-week treatment program. Potential participants were excluded if they were significantly cognitively impaired, or actively suicidal, or did not possess the physical tolerance required to attend the program. A full

description of this program has been provided by Cane and colleagues (Cane, McCarthy & Mazmanian, 2016).

All measures were administered on the first day and during the last week of the 4-week treatment program. The study procedures were approved by the Ethics Institutional Review Board. Patients also provided written informed consent for the use of their data for research purposes.

Statistical analyses

We first computed descriptive statistics for the demographic and study variables to describe the sample, means and standard deviations for continuous variables, and number and percentages for categorical variables. Then, we computed Pearson correlation coefficients between pre- to post-treatment changes in the study variables to describe their zero order associations. Next, we examined the suitability of the data to ensure that they met the assumptions for the planned regression analyses by examining the skewness and kurtosis of the distributions of the predictor variables, and by computing the variance inflation factors (VIF) for the study predictors. Finally, and in order to address the objective of this study, we performed three linear multiple regression analyses – one for each of the criterion variables of pre- to post-treatment changes in average pain intensity, pain interference, and depressive symptoms–to determine if pain catastrophizing, pain willingness, and activity engagement explained unique variance in the criterion variables.

For the analysis with pain intensity as the criterion variable, we entered age and sex to control for their potential effects in step 1. Then, in step 2, we entered change scores representing pre- to post-treatment changes in pain catastrophizing, pain willingness, and activity engagement. For the other two

regression analysis (with pain interference, and depressive symptomatology as the criterion variables) we also controlled for potential effects of the changes in pain intensity. Thus, in step 1 we entered age and sex, and in step 2 we entered pre- to post-treatment changes in pain intensity to control for their potential effects on both the primary predictor and criterion variables. In step 3 we entered the change scores in pain catastrophizing, activity engagement and pain willingness as a block.

Due to the large number of planned analyses in this study it was necessary to lower the alpha level required for significance in order to control for Type I error and increase the confidence that any significant findings would be reliable. However, a highly conservative approach, such as the *Bonferroni* strategy, would result in a *p* value so low that it would substantially increase the risk of Type II errors. Thus, we elected to balance the need to control for both types of errors by using a *p* value of 0.01 for determining that a finding was statistically significant.

RESULTS

Assumptions testing

As shown by skewness and kurtosis statistics, the distributions of the study variables were adequately normal for the planned regression analyses (skewness range = -0.70 to 1.07; kurtosis range =–0.64 to 1.32). Furthermore, all of the variance inflation factor values were below the standard cutoff value of 10 (ranging from 1.01 to 1.67), indicating that multicollinearity would not bias the findings (Tabachnick & Fidell, 1996).

Correlations among the pre- to post-treatment changes in the study variables

Zero order Pearson correlations between pre- to post-treatment changes in the study variables were performed. Table 2 provides the results of these analyses, along with means and standard deviations of the change values. Consistent with expectations, changes in Activity Engagement and Pain Willingness scale scores were positively correlated (r = .27, p < .01). Similarly, as hypothesized, changes in the Pain Catastrophizing Scale scores were significantly negatively correlated with changes in the Activity Engagement (r = -.32, p < .01) and changes in the Pain Willingness (r = -.40, p < .01) scale scores. Although the pattern of associations among the change scores in the Activity Engagement, Pain Willingness, and Pain Catastrophizing Scale scores were as expected, they were weak enough to suggest that they might be independent domains.

[Insert Table 2 about here]

In addition, and as hypothesized, changes in the Beck Depression Inventory scores demonstrated significant (p < .01) univariate associations with changes in the measures of catastrophizing (positive association), activity engagement, and pain willingness (both negative associations). However, only changes in pain willingness and activity engagement were significantly associated with changes in pain interference, and only changes in catastrophizing and activity engagement were associated with changes in pain intensity (see Table 2).

Regression analyses predicting changes in pain intensity

The results of the regression analyses predicting changes in pain intensity are presented in Table 3. Only the block of predictors including changes in pain catastrophizing, activity engagement and pain willingness

made a significant contribution, explaining 10% of the variance in pre- to post-treatment changes in pain intensity. An examination of the beta weights indicated that only changes in pain catastrophizing contributed unique variance to this effect ($\beta = 0.25$, $p < 0.01$). Consistent with the study hypotheses, a decrease in pain catastrophizing was associated with a decrease in pain intensity.

[Insert Table 3 about here]

Regression analyses predicting changes in pain interference

As can be seen in Table 4, changes in pain intensity contributed significantly to the prediction of the changes in pain interference ($\beta = 0.16$, $p < 0.01$), accounting for a 5% of the variance. The block of predictors including changes in pain catastrophizing, activity engagement and pain willingness also made a significant additional contribution of 16% of the variance in the criterion variable. An examination of the beta weights indicated that only changes in activity engagement contributed uniquely to this effect ($\beta = 0.37$, $p < 0.001$). The direction of the beta weight indicated that an increase in activity engagement was associated with a greater decrease in pain interference.

[Insert Table 4 about here]

Regression analyses predicting changes in depressive symptoms

The results of the regression analyses predicting depressive symptoms are presented in Table 5. As can be seen, only the block of predictors (changes in activity engagement, in pain willingness and pain catastrophic thinking) as a group made a statistically significant contribution to the prediction of the criterion (16% of the variance). However, and inconsistent with the study

hypotheses, none of the change scores made statistically significant independent contributions to the prediction of changes in depressive symptoms.

[Insert Table 5 about here]

DISCUSSION

The primary aim of this study was to evaluate the roles that changes in pain catastrophizing and the two components of pain acceptance, pain willingness and activity engagement, play in explaining the benefits of multidisciplinary cognitive behaviorally (CBT)-based chronic pain treatment. Two key findings emerged. First, although the pattern of univariate associations were generally consistent with the study hypotheses, only pain catastrophizing and activity engagement emerged as significant unique predictors of any treatment outcome; pain willingness was not found to be a significant unique predictor of either outcome variable, when catastrophizing and activity engagement were controlled. This negative finding in relation to pain willingness is similar to results observed in previous studies of this construct (e.g., Day & Thorn, 2016). Second, changes in catastrophizing and activity engagement showed somewhat different patterns of unique (i.e., when controlling for the other study variables) associations with outcomes, with decreases in catastrophizing being associated with improvements in pain intensity and depressive symptoms, and increases in activity engagement predicting improvements in pain interference.

These findings are consistent with previous studies showing that pain catastrophizing is an important and unique predictor of treatment outcomes in chronic pain management (Moore, Thibault, Adams, & Sullivan, 2016; Quartana, Campbell, & Edwards, 2009). Moreover, the results are consistent

with a previous study comparing activity engagement and pain willingness as predictors of chronic pain treatment outcomes, showing that activity engagement, but not pain willingness, mediated improvements in pain interference after completing a mindfulness-based program (Day & Thorn, 2016). Our results confirm and extend these preliminary findings to a wider heterogeneous sample of patients with chronic pain participating in a different (CBT-based) treatment.

Pain catastrophizing has been shown to play a central role in CBT-based treatments for individuals with chronic pain (Elvery, Jensen, Ehde, & Day, 2016; Quartana et al., 2009). However, as shown in this study, other process variables may also have a role in explaining improvements. Importantly, pain acceptance, which is a key process variable in Acceptance and Commitment Therapy has been found to play also a role in the outcomes after participating in a multidisciplinary CBT-based treatment for chronic pain, for example, on pain intensity, disability or depressive symptoms (Åkerblom, Perrin, Fischer, & McCracken, 2015). Although we used a different study design, this finding was also observed in the current study. However, we found that activity engagement (but not pain willingness), may be the key acceptance factor relating to improvement.

Although both variables (i.e., pain catastrophizing and activity engagement) are central to two allegedly different therapeutic models (McCracken, 2005), encouraging pain acceptance is also consistent with classic cognitive therapy as it has been applied to chronic pain treatment. For example, when, as described by Jensen (Jensen, 2011), a therapist facilitates an understanding that some thoughts about pain (e.g., “My pain is a sign of

physical damage") are not necessarily true and can be maladaptive in and of themselves.

Thus, in chronic pain management it may not only be important to address the cognitive content, that is, *what* the patient thinks about pain (e.g., to reduce the occurrence of catastrophizing thoughts), but also to address cognitive processes, that is, *how* the patient thinks about pain (e.g., to improve willingness to engage in valued activities despite pain), in order to respond to pain in a more effective and adaptive manner (Day et al., 2014; Jensen, 2011). If future research finds that the correlations found here reflect causal processes – that both catastrophizing and activity engagement have *causal* influences on outcomes – it would be important to target both in treatment.

This study has a number of limitations that should be considered when interpreting the results. First, although the number of participants was appropriate for the analyses which were conducted, the sample size was relatively small. Additional research, ideally with larger sample sizes, would be needed to establish the reliability of findings. Second, although the study design allowed for the evaluation of concurrent associations among the change scores for the study variables, the study remains a correlational study; we were not able to test for causal associations, and attribute specific changes to the particular characteristics of the intervention. Thus, additional studies, such as clinical trials in which activity engagement and pain willingness are specifically targeted for change in treatment conditions (*versus* a control condition where these process variables are not specifically targeted for change), are needed to evaluate the causal influence of each of these factors on treatment outcomes. Finally, in this study we collected information at pre- and post-treatment, but did

not collect information at different stages during treatment. Future studies would profit from including some more finer-grained assessments (i.e., daily or weekly measures of both mechanism and outcome measures during treatment), which would enable a more detailed analysis of potential underlying mechanisms of treatment change.

Despite the study's limitations, the findings provide important additional information on the relative importance of two specific treatment process variables: pain catastrophizing and activity engagement. The findings are consistent with the possibility that chronic pain treatments which help to both reduce pain catastrophizing and increase activity engagement may be more beneficial than treatments that target only one of these factors for change. The current findings indicate that research to address this question is warranted.

ACKNOWLEDGEMENTS

This work was partly funded by grants from the Spanish Ministry of Science and Competitiveness (MINECO; PSI2014-60180-JIN; PSI2015-70966-P; PSI2016-82004-REDT), Obra Social de Caixabank and the European Regional Development Fund (ERDF). SG is supported by a doctoral grant from the Spanish Ministry of Science and Competitiveness. RV is supported by a Beatriu de Pinós Postdoctoral Fellowship (2014 BP-A 00009) granted by the Agency for Administration of University and Research Grants (AGAUR). JM is supported by the Institució Catalana de Recerca i Estudis Avançats (ICREA-Acadèmia) and Fundación Grünenthal.

REFERENCES

Åkerblom, S., Perrin, S., Fischer, M. R., & McCracken, L. M. (2015). The Mediating Role of Acceptance in Multidisciplinary Cognitive Behavioral Therapy for Chronic Pain. *The Journal of Pain*, *16*(7), 606–15. http://doi.org/10.1016/j.jpain.2015.03.007

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*(6), 561–571. http://doi.org/10.1001/archpsyc.1961.01710120031004

Benzon, H. T., Rathmell, J. P., Wu, C. L., Turk, D. C., Argoff, C. E., & Hurley, R. W. (2013). *Practical management of pain*. Philadelphia, PA: Elsevier.

Burns, J. W., Glenn, B., Bruehl, S., Harden, R. N., & Lofland, K. (2003). Cognitive factors influence outcome following multidisciplinary chronic pain treatment: A replication and extension of a cross-lagged panel analysis. *Behaviour Research and Therapy*, *41*(10), 1163–1182. http://doi.org/10.1016/S0005-7967(03)00029-9

Burns, J. W., Kubilus, A., Bruehl, S., Harden, R. N., & Lofland, K. (2003). Do changes in cognitive factors influence outcome following multidisciplinary treatment for chronic pain? A cross-lagged panel analysis. *Journal of Consulting and Clinical Psychology*, *71*(1), 81–91. http://doi.org/10.1037/0022-006X.71.1.81

Cane, D., McCarthy, M., & Mazmanian, D. (2016). Obstacles to activity pacing: assessment, relationship to activity and functioning. *Pain*, *157*, 1508–1514. http://doi.org/10.1097/j.pain.0000000000000553

Cederberg, J. T., Cernvall, M., Dahl, J. A., von Essen, L., & Ljungman, G. (2016). Acceptance as a Mediator for Change in Acceptance and

Commitment Therapy for Persons with Chronic Pain? *International Journal of Behavioral Medicine*, *23*(1), 21–29. http://doi.org/10.1007/s12529-015-9494-y.

Day, M. A., Jensen, M.P., Ehde, D.M., & Thorn, B. E. (2014). Toward a theoretical model for mindfulness-based pain management. *Journal of Pain*, *15*, 691-703.

Day, M. A., & Thorn, B. E. (2016). The mediating role of pain acceptance during mindfulness-based cognitive therapy for headache. *Complementary Therapies in Medicine*, *25*, 51–54. http://doi.org/10.1016/j.ctim.2016.01.002

Ehde, D. M., Dillworth, T. M., & Turner, J. A. (2014). Cognitive-behavioral therapy for individuals with chronic pain: Efficacy, innovations, and directions for research. *American Psychologist*, *69*(2), 153–166. http://doi.org/10.1037/a0035747

Elvery, N., Jensen, M. P., Ehde, D. M., & Day, M. A. (2016). *Pain Catastrophizing, Mindfulness and Pain Acceptance: What's the Difference? The Clinical Journal of Pain* (Vol. epub). http://doi.org/10.1097/AJP.0000000000000430

Huguet, A., Miró, J., & Nieto, R. (2008). The inventory of parent/caregiver responses to the children's pain experience (IRPEDNA): development and preliminary validation. *Pain*, *134*(1–2), 128–39. http://doi.org/10.1016/j.pain.2007.04.004

Jensen, M. P. (2011). Psychosocial approaches to pain management: An organizational framework. *Pain*, *152*(4), 717–725. http://doi.org/10.1016/j.pain.2010.09.002

Jensen, M. P., Castarlenas, E., Tomé-Pires, C., de la Vega, R., Sánchez-Rodríguez, E., & Miró, J. (2015). The Number of Ratings Needed for Valid Pain Assessment in Clinical Trials: Replication and Extension. *Pain Medicine (United States)*, *16*(9), 1764–1772. http://doi.org/10.1111/pme.12823

Jensen, M. P., & Karoly, P. (2011). Self-report scales and procedures for assessing pain in adults. In D. C. Turk & R. Melzack (Eds.), *Handbook of pain assessment* (3rd ed., pp. 19–44). New York: Guilford Press.

Jensen, M. P., Tomé-Pires, C., Solé, E., Racine, M., Castarlenas, E., de la Vega, R., & Miró, J. (2015). Assessment of pain intensity in clinical trials: Individual ratings vs composite scores. *Pain Medicine (United States)*, *16*(1), 141–148. http://doi.org/10.1111/pme.12588

Jensen, M. P., & Turk, D. C. (2014). Contributions of psychology to the understanding and treatment of people with chronic pain: why it matters to ALL psychologists. *The American Psychologist*, *69*(2), 105–118. http://doi.org/10.1037/a0035641

McCracken, L. M. (2005). *Contextual Cognitive-Behavioral Therapy for Chronic pain*. Seattle: IASP Press.

McCracken, L. M., Vowles, K. E., & Eccleston, C. (2004). Acceptance of chronic pain: Component analysis and a revised assessment method. *Pain*, *107*(1–2), 159–166. http://doi.org/10.1016/j.pain.2003.10.012

Miró, J., Nieto, R., & Huguet, A. (2008). The Catalan version of the Pain Catastrophizing Scale: a useful instrument to assess catastrophic thinking in whiplash patients. *The Journal of Pain : Official Journal of the American Pain Society*, *9*(5), 397–406. http://doi.org/10.1016/j.jpain.2007.12.004

Moore, E., Thibault, P., Adams, H., & Sullivan, M. J. L. (2016). Catastrophizing and pain-related fear predict failure to maintain treatment gains following participation in a pain rehabilitation program. *PAIN Reports*, *1*(2), e567. http://doi.org/10.1097/PR9.0000000000000567

Nieto, R., Miró, J., Huguet, A., & Saldaña, C. (2011). Are coping and catastrophising independently related to disability and depression in patients with whiplash associated disorders? *Disability and Rehabilitation*, *33*(5), 389–398. http://doi.org/10.3109/09638288.2010.491576

Nieto, R., Raichle, K. A., Jensen, M. P., & Miró, J. (2012). Changes in pain-related beliefs, coping, and catastrophizing predict changes in pain intensity, pain interference, and psychological functioning in individuals with myotonic muscular dystrophy and facioscapulohumeral dystrophy. *The Clinical Journal of Pain*, *28*(1), 47–54. http://doi.org/10.1097/AJP.0b013e31822019b1

Quartana, P. J., Campbell, C. M., & Edwards, R. R. (2009). Pain catastrophizing : a critical review. *Expert Rev Neurother*, *9*(5), 745–758. http://doi.org/10.1586/ERN.09.34.Pain

Racine, M., Sanchez-Rodriguez, E., Galan, S., Tome-Pires, C., Sole, E., Jensen, M. P., … Choiniere, M. (2016). Factors Associated with Suicidal Ideation in Patients with Chronic Non-Cancer Pain. *Pain Medicine (Malden, Mass.)*. http://doi.org/10.1093/pm/pnw115

Reneman, M. F., Dijkstra, A., Geertzen, J. H. B., & Dijkstra, P. U. (2010). Psychometric properties of Chronic Pain Acceptance Questionnaires: A systematic review. *European Journal of Pain*, *14*(5), 457–465. http://doi.org/10.1016/j.ejpain.2009.08.003

Richardson, E. J., Ness, T. J., Doleys, D. M., Baños, J. H., Cianfrini, L., & Richards, J. S. (2010). Catastrophizing, acceptance, and interference: laboratory findings, subjective report, and pain willingness as a moderator. *Health Psychology : Official Journal of the Division of Health Psychology, American Psychological Association*, *29*(3), 299–306. http://doi.org/10.1037/a0018834

Stone, A. A., Schneider, S., Broderick, J. E., & Schwartz, J. E. (2014). Single-day pain assessments as clinical outcomes: not so fast. *The Clinical Journal of Pain*, *30*(9), 739–743. http://doi.org/10.1097/AJP.0000000000000030

Sullivan, M. J. L., Bishop, S., & Pivik, J. (1995). The pain catastrophizing scale: development and validation. *Psychol Assess*, *7*(4), 432–524. http://doi.org/10.1037/1040-3590.7.4.524

Tabachnick, BG, Fidell, L. (1996). *Using multivariate statistics* (6th ed.). Harlow: Pearson.

Tait, R. C., Chibnall, J. T., & Krause, S. (1990). The Pain Disability Index: psychometric properties. *Pain*, *40*(2), 171–182.

Tait, R. C., Pollard, C. A., Margolis, R. B., Duckro, P. N., & Krause, S. J. (1987). The Pain Disability Index: psychometric and validity data. *Archives of Physical Medicine and Rehabilitation*, *68*(7), 438–441.

Van Damme, S., Crombez, G., Bijttebier, P., Goubert, L., & Van Houdenhove, B. (2002). A confirmatory factor analysis of the Pain Catastrophizing Scale: invariant factor structure across clinical and non-clinical populations. *Pain*, *96*(0304–3959), 319–324. http://doi.org/10.1016/S0304-3959(01)00463-8

Vowles, K. E., McCracken, L. M., & Eccleston, C. (2007). Processes of change in treatment for chronic pain: The contributions of pain, acceptance, and

catastrophizing. *European Journal of Pain*, *11*(7), 779–787.

http://doi.org/10.1016/j.ejpain.2006.12.007

Table 1. Description of the study sample (N = 186).

Variable	Percent	N	Mean (SD)	Range
Age, years		186	50.30 (11.18)	22.6 – 78.5
Sex				
Men	36%	66		
Women	64%	120		
Marital status[a]				
Married/Common-law	47%	87		
Divorced/Separated	14%	26		
Widowed	3%	6		
Never Married	8%	16		
Highest level of education[a]				
Primary school	3%	5		
Secondary school	25%	47		
College or University	42%	78		
Current work status[a]				
Working	9%	16		
Volunteer	1%	1		
Homemaker	3%	5		
Unemployed	5%	10		
On disability	33%	62		
Retired	14%	27		
Student	1%	2		
Other	6%	12		

Note: [a] Missing information for “Marital status” in 51 cases, education in 56, and work status in 51 of the cases.

Table 2. Means (M) and Standard deviations (SD), and Pearson correlations between pre- and post-treatment changes of the variables in the study.

Variable	M (SD)	BDI	*PI*	*AE*	*PW*	PDI
PCS	4.41 (8.11)	.33*	.25*	.32*	.40*	.16
BDI	4.61 (6.95)		.14	-.31*	-.28*	.09
PI	0.41 (0.94)			-.22*	-.05	.23*
AE	-4.02 (8.24)				.27*	-.42*
PW	-1.81 (6.60)					-.25*

Note: PCS = Pain Catastrophizing Scale; BDI = Beck Depression Inventory; PI = Pain intensity composite score; AE = Activity Engagement; PW = Pain willingness; PDI = Pain Disability Index.

* P < .001

Table 3. Predicting changes in Pain intensity.

Step and variable	Total R^2	R^2 change	F change	β to enter
1. Sociodemographic variables	.01	.01	0.23	
2. Predictors	.11	.10	5.99*	
Change in Activity Engagement				-.15
Change in Pain Willingness				.09
Change in Catastrophizing				.25*

Note: *p < .005

Table 4. Predicting changes in Pain interference.

Step and variable	Total R^2	R^2 change	F change	β to enter
1. Sociodemographic variables	.05	.05	3.97	
2. Average pain intensity	.10	.05	8.19*	.16*
3. Predictors	.26	.16	10.15**	
Change in Activity Engagement				-.37**
Change in Pain Willingness				-.14
Change in Catastrophizing				-.08

Note: *p < .01; **p < .001

Table 5. Predicting changes in Depressive symptomatology.

Step and variable	Total R^2	R^2 change	F change	β to enter
1. Sociodemographic variables	.01	.01	.92	.02
2. Average pain intensity	.03	.02	3.52	.06
3. Predictors	.19	.16	9.04*	
Change in Activity Engagement				-.19
Change in Pain Willingness				-.15
Change in Catastrophizing				.20

Note: *$p < .01$