The relationship between acceptance, catastrophizing and illness representations in chronic pain

The Relationship between Acceptance, Catastrophizing and Illness Representations in Chronic Pain

Running head: Acceptance and Appraisal in Chronic Pain

David T. Gillanders*, University of Edinburgh / NHS Lothian Chronic Pain Service

Nuno B. Ferreira, University of Edinburgh, United Kingdom

Sujata Bose, Chronic Pain Service, NHS Tayside, United Kingdom

Tammy Esrich, Chronic Pain Service, NHS Tayside, United Kingdom

*Corresponding author

Address: School of Health in Social Science
University of Edinburgh
Medical School
Teviot Place
Edinburgh
Eh8 9AG
United Kingdom
david.gillanders@ed.ac.uk
Tel: +44(0)131 651 3946
Fax: +44(0)131 651 3971

Article Type: Original article in Therapeutics and Psychology

This study was Sujata Bose's clinical psychology doctoral project and was not funded by external grant.

There are no conflicts of interest to declare in this work

What is already known about this subject?

- Illness representations and catastrophising are known to influence chronic pain adjustment.
- Acceptance is a quality of behaviour that also influences chronic pain adjustment.

What does this study add?

- Acceptance, catastrophising and illness representations are related to each other in theoretically coherent ways.
- Acceptance, catastrophising and illness representations show specific patterns of mediation between pain and outcomes.
- Catastrophizing and emotional representations influence emotional dysfunction, whilst acceptance has more influence on physical disability.

The Relationship between Acceptance, Catastrophizing and Illness Representations in Chronic Pain

Abstract

Background: Cognitive and acceptance based approaches are used to help people live with chronic pain. Little is known about how these constructs relate to each other. In this study we examined how cognitive representations of chronic pain relate to interpersonal styles such as catastrophizing and the behavioural process of acceptance of chronic pain. This study further examined how these processes relate to emotional and physical functioning in chronic pain.

Methods: A cross sectional design, employing validated questionnaires was used to measure pain, emotional and physical dysfunction, illness representations, catastrophizing and acceptance in a heterogeneous sample of 150 chronic pain sufferers.

Results: The psychological variables significantly mediated the impact of pain severity on both emotional and physical dysfunction. In addition, a distinct pattern of mediation was observed. The relationship between pain and emotional dysfunction was mediated by representations of pain as a highly emotive experience and by catastrophizing; acceptance did not mediate this relationship. By contrast, the relationship between pain and physical dysfunction was mediated by acceptance and representations of high consequences of chronic pain, but not by catastrophising.

Conclusions: Pain severity itself is a relatively poor predictor of emotional and physical dysfunction in chronic pain states. These relationships are significantly mediated by psychological variables. Different approaches to chronic pain rehabilitation emphasise different targets (changing illness representations and reducing catastrophizing vs. acceptance and behavioural activation). This cross sectional study suggests that these processes may

differentially influence outcomes, but that they are complex and overlapping. Theoretical and clinical implications are discussed.

Introduction

It is now well established that psychological factors influence the relationship between chronic pain and outcomes such as disability and distress, with behavioural and cognitive factors being the strongest evidenced (e.g. Turk et al., 2008). This data consists of cross sectional, experimental and intervention studies (e.g. Jensen et al., 2001; Woby et al., 2004; Eccleston et al., 2009; Bailey et al., 2010).

Recently, Acceptance and Commitment Therapy (ACT; Hayes et al., 1999, 2011) has put forward acceptance as an important contextual behavioural factor in the conceptualization of chronic pain (e.g. McCracken, 2005). The word 'acceptance' is often synonymous with notions of 'toleration' or 'giving in', however, in ACT, 'acceptance' is seen as a quality of behaviour: A choice to mindfully acknowledge pain experiences (intensity, thoughts, emotions) and to cease efforts to control them while engaging in valued behaviours, particularly when control efforts lead to life restriction. Recent studies have shown acceptance to be associated with important outcomes in chronic pain such as distress, quality of life or disability (e.g. Mccracken and Eccleston, 2003; Dahl et al., 2005; Masedo and Esteve, 2007; Wicksell et al., 2010). In ACT the primary target of change is the context in which a person relates to her pain experiences rather than the cognitive content of the experiences themselves. Several studies have attested to the efficacy of this approach (e.g.Veehof et al., 2011; Wetherell et al., 2011; Vowles and McCraken, 2010; Wicksell et al., 2008).

Although this contextual behavioural model has been gaining support it is important to recognize the relevance of other cognitive content based models. For example, illness representations (Self-Regulatory model; Leventhal et al., 1997) have been shown to be good

predictors of chronic pain outcomes (e.g. Galli et al., 2010; Foster et al., 2008). Pain catastrophizing has also been shown to be a good predictor of pain outcomes (e.g. Edwards et al., 2006; Sullivan et al., 2001). Although originally proposed as an 'exaggerated negative orientation towards noxious stimuli' (Sullivan et al., 1995, p. 524), Sullivan (2012) has recently highlighted that the predictive power of catastrophizing is more usefully considered to be a feature of the interpersonal context in which pain occurs rather than a cognitive content factor.

These findings promote a discussion regarding the relative importance of contextual vs. cognitive content factors in the conceptualization of successful adaptation to chronic pain. Readers interested in this distinction between content and context should refer to McCracken (2011, p. 15 & 16). Some studies have investigated the relations of acceptance and illness representations (e.g. Rankin and Holttum, 2003) or acceptance and catastrophizing (e.g. Vowles et al., 2008) and their influence in chronic pain outcomes, with acceptance consistently proving to be a valuable predictor, however no study has looked at all of these factors together.

This cross-sectional study investigates how context and content factors relate to each other and to pain outcomes, while also comparing their relative importance as mediators between pain intensity and outcomes of distress and disability.

Method

Design

In a cross sectional design, attendees at 2 National Health Service multi-disciplinary pain centres and a voluntary sector patient support organisation were recruited. They were given questionnaire packs that contained information sheets, consent forms, a stamped-addressed envelope and 7 validated questionnaires of pain severity, illness representations, pain catastrophising, pain acceptance, disability, and emotional distress / depression.

Inclusion and exclusion criteria

Patients were eligible to participate if they were aged 18 years or over and experienced chronic pain in any location of the body of a minimum duration of 6 months. Patients were excluded on the basis of having a malignant or terminal condition such as cancer. Other exclusion criteria were people with intellectual impairment (e.g. learning disability, Alzheimer's dementia), severe mental illness, and primary alcohol or substance misuse problem. These criteria were assessed by pain clinic consultant or by self-report for those recruited from the support organisation.

Participants

240 adults with chronic pain were invited to participate. One hundred and fifty nine individuals returned questionnaires with signed consent forms (return rate = 66.3 %). Nine individuals were excluded due to not meeting inclusion and exclusion criteria, or because they had more than 10% missing data. Of the total of 150 participants, 99 individuals (66.7 %) were female and 44 individuals (28.8 %) were male, with 7 individuals not stating their gender. Their mean age was 50.8 years, (SD = 13.2) and their average duration of pain was 10 years (SD = 8.6 years). Average self-reported pain intensity, measured with the Short-Form McGill Pain Questionnaire (MPQ-SF: Melzack, 1987), was 18.02 out of 50 (SD = 10.05). Participants had a variety of sites of pain, with back pain being the most common (36%), followed by legs (22%), neck (14%) and head or face (11%). The remaining pain locations were abdomen, chest, all over body and other. They reported having had a variety of treatments, with prescribed medication, physiotherapy, acupuncture and TENS the most common treatments. The sample is considered to be a representative sample, typical of patients seen for chronic pain in multi-professional pain centres (see Table 1 for a comparison of this sample with other chronic pain samples). (Rippentrop et al., 2005)(Pallant and Bailey, 2005)(Crombez et al., 1999)(Moss-Morris et al., 2002) (Sullivan et al., 2006)(Wetherell et al., 2011)

Measures

Demographic questionnaire

This questionnaire was designed by the investigators to elicit demographic information from participants. Questions were included about site(s) of pain, duration and onset of pain, as well as current and past treatments.

McGill Pain Questionnaire – Short Form (MPQ-SF: Melzack, 1987)

The MPQ-SF consists of 15 descriptors rated on an intensity scale from 0 = none to 3 = severe. It also includes the Present Pain Intensity (PPI) scale, which is rated using one of five pain descriptors (mild, discomforting, distressing, horrible and excruciating). The MPQ-SF generates two subscale scores that reflect the sensory aspect of pain and the affective or unpleasantness aspect of pain. These subscales scores are combined to provide a total pain intensity score. The MPQ-SF is widely used with chronic pain populations and has established validity and reliability (Katz and Melzack, 1999; Melzack, 1987). For clarity, in this study the total pain intensity score is used.

Chronic Pain Acceptance Questionnaire (CPAQ: McCracken et al., 2004)

The CPAQ is a 20-item measure of acceptance of chronic pain, with two subscales derived from factor analyses: activities engagement (11 items) and pain willingness (9 items). The CPAQ has been shown to have adequate internal consistency and reliability (α = 0.78–0.82) (McCracken et al., 2004). The factor structure of the CPAQ has been replicated in a confirmatory factor analysis (Vowles et al., 2008b). Data from several studies demonstrate that CPAQ total scores are correlated with standardised measures of emotional distress and daily functioning, supporting its validity as a measure of acceptance (McCracken, 1998; McCracken et al., 1999, 2004). In addition the CPAQ is sensitive to changes following acceptance-based treatment for chronic pain and these changes mediate the relationship between treatment and outcome (Vowles and McCraken, 2010; Vowles et al., 2009).

Pain Catastrophising Scale (PCS: Sullivan et al., 1995)

The PCS is a 13-item scale that measures interpersonal behaviour in relation to pain. It is best considered a measure of a mind set or orientation towards pain and consists of three subscales: rumination, magnification and helplessness. It has been demonstrated to have high internal consistency (α = 0.87), good reliability and validity in clinical and experimental samples as well as conceptual distinctiveness from related cognitive-affective constructs e.g. clinical depression (Sullivan et al., 1995). The PCS has been widely used to examine the role of catastrophising in the chronic pain population (e. g. Severeijns et al., 2001; Sullivan et al., 2001; Turner et al., 2004).

Illness Perceptions Questionnaire –Revised (IPQ-R: Moss-Morris et al., 2002)

The IPQ-R measures the different dimensions of illness representations that are derived from Leventhal's self-regulatory model (Leventhal et al., 1997). Items assess the cognitive representations of illness identity (how much are symptoms experienced), timeline-acute/chronic (how long will the illness last), timeline-cyclical (how often one believes the illness is likely to re-occur) consequences (how much does this illness affect life), personal control (how much control one feels over the illness), treatment control (how much will treatment help), illness coherence (how much does one understand the illness), and emotions (How much does the illness affect emotionally) Items are scored on a five-point scale ranging from 'strongly agree' to 'strongly disagree'. The IPQ-R has been widely used in chronic illness populations including chronic pain. Validity and reliability have been established for the measure (Moss-Morris et al., 2002).

Roland-Morris Disability Scale (RDQ: Roland and Morris, 1983)

The RDQ is a 24-item questionnaire designed to assess level of physical functioning. It was initially developed for those with chronic lower-back pain and has good reliability and validity for this population (Roland and Fairbank, 2000). Jensen et al., (1992) conclude that the reliability

and validity of the scale is also acceptable in a heterogeneous group of chronic pain patients, and its short length makes it suitable for research.

Hospital Anxiety and Depression Scale (HADS: Zigmond and Snaith, 1983)

The HADS is widely used for measuring anxiety and depression in clinical populations with physical illness. It contains 14 items and gives an overall measure of emotional distress as well as depression and anxiety subscale scores. It has shown good internal consistency ($\alpha = 0.90 – 0.93$), validity and test-retest reliability (Moorey et al., 1991; Snaith and Zigmond, 1994; Bjelland et al., 2002). For simplicity in this study we used a total score to represent emotional dysfunction.

Data Analysis

Preliminary analyses were performed to check for missing data, normality and adequacy for mediation analysis. Also, a series of t-tests compared our sample with those from other published studies with chronic pain populations using the same measures. A first set of bivariate Pearson's correlation analyses explored the relations between the proposed mediators of context and cognitive content variables with each other. A second set of correlations investigated the relations of the proposed mediators with pain experiences (proposed independent variable) and emotional distress and physical disability (proposed dependent variables). Given the number of analyses run on each measure of the context and cognitive content measures, a $p<.005$ significance level was adopted to control for Type I errors. Theoretically specified multiple mediation analysis using both the product of coefficients approach and bootstrapping, as described by Preacher and Hayes (Preacher and Hayes, 2008; Hayes, 2009) was used to investigate the relative importance that context and cognitive content variables have in the mediation of the relation between pain experiences (severity) and pain outcomes (physical and emotional).

Results

Preliminary analyses

In the 150 participants that were included missing data was low. In order to maximize the sample size available for analysis, estimation maximisation was used to impute missing values, based upon participants' own scores for the variables that were not missing. The distributions, means and standard deviation of the imputed variables did not differ from the original data. All assumptions for parametric analyses were met, for all variables, except the following: Catastrophising (PCS) and Physical Dysfunction (RDQ) demonstrated significant negative kurtosis. Standard transformations (square root, inverse and log transformations) were conducted on these variables but did not remove kurtosis. It was decided to use the untransformed data in the analyses, since negative kurtosis has little effect on analyses when sample sizes are over 100 cases (Tabachnick and Fidell, 2001). Preliminary analyses, for multiple regressions, were carried out including checks for outliers, normality of variances, linearity and lack of multicollinearity. This step was essential to verify the adequacy of the data for mediation analyses. In all cases, residual plots were normally distributed and there was no evidence that residuals were anything but randomly distributed relative to the predicted values of the dependent variables.

Descriptive data

Table 1 shows the means and standard deviations for pain severity, emotional distress, functional disability, illness representations, catastrophizing and acceptance. As the t-tests evidence, the sample collected in general was not significantly different from those of other published studies, indicating that the data collected could be seen as a good representation of the chronic pain population. Exceptions to this were the illness representations of identity and consequences with our sample seemingly perceiving a lesser experience of symptoms and a lower impact of chronic pain in their lives; illness coherence with our sample apparently having a better understanding of their illness; Another exception was that functional disability seemed to be lower in our sample, however this was only marginally different.

INSERT TABLE 1 AROUND HERE

Correlational Analysis

Table 2 shows correlation coefficients among the proposed mediator variables. Acceptance had significant negative correlations with catastrophizing and the illness representations of identity, timeline, consequences and emotional representations. Catastrophizing had a significant positive correlation with the illness representations of identity, timeline, consequences and emotional representations, whilst having a significant negative correlation with the representations of treatment control and coherence. Table 2 shows the correlation coefficients among the proposed mediators and the independent and dependent variables. Acceptance had a significant negative correlation, while catastrophizing had a significant positive correlation with all variables. The illness representations of identity, timeline, consequences and emotional representations all had significant positive correlations with all variables while treatment control had significant negative correlations with only emotional distress and physical functioning. Illness coherence had no significant association with any of the independent or dependent variables. It should be noted that the Illness representations about personal control and the cyclical nature of the illness were not significantly associated with any mediator, independent or dependent variables studied.

Overall these results indicate that there is an important relation between most of the proposed mediator variables and the experience of pain, as well as with the important outcomes of emotional and physical adjustment.

INSERT TABLE 2 AROUND HERE

Mediation analysis

Table 3 shows the direct versus indirect effects of the proposed mediators on the studied outcomes. We can see that the direct effect from pain experience to both outcomes becomes

non-significant when compared with the indirect effect accounted for by the mediators. This supports previous findings that pain intensity alone is not sufficient to explain adjustment in chronic pain. It also confirms the importance of both cognitive and contextual factors in explaining both emotional and physical outcomes. In this case the introduction of mediators allowed for a total of 63% and 45% of variance to be explained in Emotional and Physical dysfunction respectively. Tables 4 & 5 show the individual contributions in mediation of each variable considered. In the mediation model used the bootstrapped values of the 95% confidence interval that do not contain 0 between their lower and upper limits are considered to be significant mediators (Preacher and Hayes, 2008). In the physical function model tested, acceptance and the illness representation of consequences proved to significantly mediate the relations between pain severity and physical disability. This seems to indicate that how one accepts his/her pain experience and perceives the consequences of it, affects the degree of physical disability exhibited. Regarding the emotional distress model tested, catastrophizing and emotional representations significantly mediated the relation between pain intensity and emotional distress. This seems to indicate that the more one ruminates, magnifies, feels helpless and perceives pain to have a high emotional impact, the more he/she will struggle with feelings of anxiety and depression.

INSERT TABLES 3, 4 & 5 AROUND HERE

Discussion

In a representative sample of heterogeneous chronic pain patients, the combination of illness representations, catastrophizing and acceptance were found to be related to each other in theoretically predictable ways. The perceptions of a high level of symptoms, negative emotional and life consequences and that this will be endured for a long time were associated with lower acceptance and higher catastrophizing. Our study also confirmed a strong negative association between catastrophizing and acceptance. These results are in line with previous studies that have looked at the relations between these variables separately (e.g. Rankin and Holttum, 2003; Vowles et al., 2008; van Wilgen et al., 2008) and provide further evidence of the

close relationship between contextual behavioural and cognitive variables in chronic pain. Further to that, most of these variables were significantly related to both pain intensity and the outcomes of physical disability and emotional distress as previously demonstrated in various studies (e.g. Sullivan et al., 2006; McCracken and Eccleston, 2005; Galli et al., 2010). However, it is important to highlight that certain cognitive appraisals such as appraisals of control (personal or treatment), appraisals of comprehension of the illness process (coherence and cyclical) were either non-significant or very weakly associated with all variables. This could be interpreted to be in line with some of the more recent contextual behavioural conceptualizations of chronic pain, in which the role of these factors associated with attempts to cognitively control the outcomes becomes less prominent when compared to more behavioural control strategies such as avoidance or acceptance of illness experiences (Vowles and McCraken, 2010).

Our results also showed the relationships between pain intensity and emotional and physical dysfunction to be significantly mediated by a combination of the proposed contextual and cognitive variables. These results support recent models that include a more encompassing and non-exclusive conceptualization of chronic pain, in which contextual and cognitive variables are recognized to have important roles in the physical and psychological adjustment to illness (e.g. Vowles et al., 2008a; Sullivan, 2012).

More specifically, the cognitive variables of catastrophizing and perceptions of an illnesses emotional impact were found to mediate the relationship between pain and emotional functioning, whilst acceptance and perceptions regarding the consequences of chronic pain in life in general both specifically mediated the relationship between pain and disability. These results support the findings of Esteve et al. (2007) in which catastrophizing and acceptance were found to be more strongly related to outcomes of emotional distress (depression and anxiety) and functional status respectively while controlling for each other.

However it is also important to consider the different roles of acceptance and catastrophizing and that of the different cognitive appraisals found to be significant mediators. Acceptance (as defined behaviourally) appears highly influential in helping people to maintain important goal directed activity however a degree of prediction of the impact of that activity seems to be relevant. These results are in line with recent studies suggesting that the clinical use of a blend of traditional coping strategies (e.g. pacing) within a contextual behavioural framework of acceptance might be useful in promoting lower disability in chronic pain patients (Vowles and McCracken, 2010; McCracken et al., 2005). Regarding emotional distress it was unsurprising that perceptions of the emotional impact pain has in one's life were important in its the relation with pain intensity, however it was surprising that only catastrophizing and not acceptance emerged as a significant mediator, given that acceptance had shown to have a high correlation with both dependent and independent variables. One interpretation of this could be that a purely cognitive model is better at explaining this relation between pain and emotional distress. Another explanation could be seen at measurement level with the relative emphasis in the CPAQ of a behavioural operationalization of the concept of acceptance leading to a lower sensitivity to emotional components. However, recent conceptualizations of catastrophizing open the door to another possible interpretation. Sullivan (2012) in his communal coping model of catastrophizing in chronic pain, highlights the importance of contextual cues in the role catastrophizing has in the mediation between pain experiences and several outcomes. This would be in some ways consistent (although with some theoretical caveats) with ACT's proposition that it is mainly the context (including the interpersonal context) in which one relates to his/her pain experiences rather than the content of these experiences that will influence outcomes (McCracken, 2010). Therefore the observed results might reflect an overlap of conceptual elements resulting in a loss of explained variance in emotional distress from acceptance when in the presence of catastrophizing.

Overall, the finding that acceptance does not mediate between pain and emotional dysfunction does not mean that acceptance based treatment for chronic pain will have little impact upon

emotionality. Similarly, the finding that catastrophizing does not mediate the relationship between pain and disability does not mean that cognitively oriented treatment will not improve function. What these data do show, however is that the mechanism by which these variables may exert influence may be more complex than first thought. It is possible that the effect of acceptance-based treatment on emotional function may be through maintaining valued activities. There is certainly evidence that valued activity is related to acceptance and that these are both predictive of better functioning (McCracken and Yang, 2006). By contrast, cognitive interventions *may* have a more direct effect on emotional functioning by reappraisal and reducing catastrophizing. Such efforts (when successful) may operate by directly changing the meaning and interpretation of pain. Even if such an interpretation is accurate, this does not mean that patients showing high distress and negative appraisals should be treated with cognitive therapy and that those showing activity problems with acceptance and commitment therapy. Both of these treatments are broad, sophisticated, multi-component treatments that accommodate multiple treatment targets (activity, distress, thinking, emotions). How they deal with these features differs conceptually and at times at the level of technique.

What is harder to separate in practice is that both acceptance based and cognitively based treatment do share a degree of overlap at the level of technique, with behavioural interventions being common to both approaches. Theoretically these models differ in their perspective on the proposed function of behavioural interventions. In CT, behavioural interventions are undertaken to provide contradictory evidence to the pain patient's appraisals of pain, disability and the self. In ACT, behavioural interventions are more likely to be used as means of encouraging willingness and acceptance of pain whilst engaging in valued activity. Such interventions also help participants in ACT to step back from fears and beliefs about pain as reasons for inaction and hence function as 'defusion' strategies, without explicitly aiming to alter the specific form of such appraisals.

Although the use of costly large scale trials with mediation analyses to compare mechanisms of change would seem like the logical next step, this will be very difficult to achieve as recently suggested by Wetherell et al. (2011). Alternatively, and in accordance to a recent review (Veehof et al., 2011), the complexity of the interactions of contextual and cognitive factors exhibited in this study would suggest that careful patient assessment might help clinicians and researchers to address more fully which of these treatment approaches works best for which types of patients, with which types of problems and in which kinds of contexts. These kinds of research questions might be usefully addressed in single case experiment work, laboratory analogue studies and treatment component dismantling studies, in addition to randomised controlled trials.

Some limitations should be considered regarding this study. Firstly, the current study is limited by the ability of cross sectional, naturalistic designs to unravel what are complex relationships. It is clear that there is a degree of overlap between these concepts and the use of self-report questionnaires may be a relatively crude way of trying to separate these constructs, if they do in fact share significant variance. Secondly, the selection of participants and the time at which they were surveyed should be considered. Although participants were not excluded or screened on the basis of previous psychological treatment for chronic pain, they were on the whole new attendees at pain management clinics. Those participants from the pain support organisation may have been more likely to have received previous psychological or behavioural intervention, though this was not formally recorded.

In conclusion, this study has shown that the role of contextual and cognitive content variables in chronic pain is not only important but also complex. This study has also highlighted that future considerations regarding the usefulness of these variables in the conceptualization of chronic pain could be enhanced by taking a more encompassing view rather than trying to posit each variable against another. Finally this study hopes to have contributed to the discussion of future intervention models based on a more integrative approach to pain.

Acknowledgements

This work represents Sujata Bose's doctoral work. Sadly, Sujata suffered a cerebral haemorrhage and died just a few months after completing her studies. This paper is dedicated to her.

Author contributions

David Gillanders supervised the doctoral work, contributed to the conception and design of the study, reanalysed the data and wrote the manuscript for submission.

Nuno Ferreira reanalysed the data for the revised submission and helped respond to the reviewers' critique by rewriting sections of the paper.

Sujata Bose conceived the study, designed and carried out the study and recruited participants.

Tammy Spencer supervised the fieldwork of the study, contributed to the design of the study and helped in recruitment.

All authors have discussed the results, though for the reason highlighted in the acknowledgments, only David Gillanders, Nuno Ferreira and Tammy Spencer have commented on the manuscript.

References

Bailey, K. M., Carleton, R. N., and Vlaeyen, J. W. S. (2010). Treatments Addressing Pain-Related Fear and Anxiety in Patients with Chronic Musculoskeletal Pain : A Preliminary Review. Cognit Behav Ther *39*, 46–63.

Bjelland, I., Dahl, A. A., Haug, T. T., and Neckelmann, D. (2002). The validity of the hospital anxiety and depression scale: An updated literature review. J Psychosom Res *52*, 69–77.

Crombez, G., Vlaeyen, J. W., Heuts, P. H., and Lysens, R. (1999). Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. Pain *80*, 329–339.

Dahl, J., Wilson, K. G., Luciano, C., and Hayes, S. C. (2005). Acceptance and Commitment Therapy for Chronic Pain (Reno, NV: Context Press).

Eccleston, C., Williams, A., and Morley, S. (2009). Psychological therapies for the management of chronic pain (excluding headache) in adults (Review). The cochrane library.

Edwards, R. R., Bingham III, C. O., Bathon, J., and Haythornthwaite, J. A. (2006). Catastrophizing and pain in arthritis, fibromyalgia, and other rheumatic diseases. Arthrit Care Res *55*, 325–332.

Esteve, R., Ramírez-Maestre, C., and López-Marínez, A. E. (2007). Adjustment to chronic pain: the role of pain acceptance, coping strategies, and pain-related cognitions. Ann Behav Med *33*, 179–188.

Foster, N. E., Bishop, A., Thomas, E., Main, C., Horne, R., Weinman, J., and Hay, E. (2008). Illness perceptions of low back pain patients in primary care: what are they, do they change and are they associated with outcome? Pain *136*, 177–187.

Galli, U., Ettlin, D. A., Palla, S., Ehlert, U., and Gaab, J. (2010). Do illness perceptions predict pain-related disability and mood in chronic orofacial pain patients? A 6-month follow-up study. Eur J Pain *14*, 550–558.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. Commun Monogr *76*, 408–420.

Hayes, S. C., Strosahl, K. D., and Wilson, K. G. (1999). Acceptance and Commitment Therapy: an experiential approach to behaviour change (New York: The Guilford Press).

Hayes, S. C., Wilson, K. G., and Strosahl, K. (2011). Acceptance and Commitment Therapy: The Process and Practice of Mindful Change 2nd ed. (Guilford Press).

Jensen, M. P., Strom, S. E., Turner, J. a, and Romano, J. M. (1992). Validity of the Sickness Impact Profile Roland scale as a measure of dysfunction in chronic pain patients. Pain *50*, 157–162.

Jensen, M. P., Turner, J. A., and Romano, J. M. (2001). Changes in Beliefs , Catastrophizing , and Coping Are Associated With Improvement in Multidisciplinary Pain Treatment. J Consult Clin Psych *69*, 655–662.

Katz, J., and Melzack, R. (1999). Measurement of Pain. Surg Clin N Am *79*, 231–252.

Leventhal, H., Benyamini, Y., Brownlee, S., Diefenbach, M., Leventhal, E. A., Patrick-Miller, L., and Robitaile, C. (1997). Illness Representations: theoretical foundations. In Perceptions of Health and Illness, J. Petrie and J. Wienman, eds. (amsterdam: Harwood Academic Press).

Masedo, A. I., and Esteve, M. R. (2007). Effects of suppression, acceptance and spontaneous coping on pain tolerance, pain intensity and distress. Behav Res Ther *45*, 199–209.

McCracken, L. M. (2005). Contextual Cognitive-behavioural therapy for chronic pain (Seattle, WA: IASP Press).

McCracken, L. M. (1998). Learning to live with the pain: acceptance of pain predicts adjustment in persons with chronic pain. Pain *74*, 21–27.

McCracken, L. M. (2010). Toward understanding acceptance and psychological flexibility in chronic pain. Pain *149*, 420–421.

McCracken, L. M. (2011). History, context and new developments in behavioral medicine. In L. McCracken (Ed.) *Mindfulness and Acceptance in Behavioural Medicine,* Oakland: New Harbinger.

McCracken, L. M., and Eccleston, C. (2005). A prospective study of acceptance of pain and patient functioning with chronic pain. Pain *118*, 164–169.

McCracken, L. M., Spertus, I. L., Janeck, A. S., Sinclair, D., and Wetzel, F. T. (1999). Behavioral dimensions of adjustment in persons with chronic pain: pain-related anxiety and acceptance. Pain *80*, 283–289.

McCracken, L. M., Vowles, K. E., and Eccleston, C. (2005). Acceptance-based treatment for persons with complex, long standing chronic pain: A preliminary analysis of treatment outcome in comparison to a waiting phase. Behav Res Ther *43*, 1335–1346.

McCracken, L. M., and Yang, S. (2006). The role of Values in a contextual cognitive-behavioural approach to chronic pain. Pain *123*, 137–145.

McCracken, L., Vowles, K. E., and Ecclesston, C. (2004). Acceptance of chronic pain: component analysis and a revised assessment method. Pain *107*, 159–166.

Mccracken, L. M., and Eccleston, C. (2003). Coping or acceptance : what to do about chronic pain ? Pain *105*, 197–204.

Melzack, R. (1987). The short-form McGill Pain Questionnaire. Pain *30*, 191–197.

Moorey, S., Greer, S., Watson, M., Gorman, C., Rowden, L., Tunmore, R., Robertson, B., and Bliss, J. (1991). The factor structure and factor stability of the hospital anxiety and depressession scale. British J Psychiat *158*, 255–259.

Moss-Morris, R., Weinman, J., Petrie, K., Horne, R., Cameron, L., and Buick, D. (2002). The Revised Illness Perception Questionnaire (IPQ-R). Psychol Health *17*, 1–16.

Pallant, J. F., and Bailey, C. M. (2005). Assessment of the structure of the Hospital Anxiety and Depression Scale in musculoskeletal patients. Health Qual Life Outcomes *9*, 1–9.

Preacher, K. J., and Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav Res Meth *40*, 879–891.

Rankin, H., and Holttum, S. E. (2003). The relationship between acceptance and cognitive representations of pain in participants of a pain management programme. Psycho Health Med *8,* 329-334.

Rippentrop, E. a, Altmaier, E. M., Chen, J. J., Found, E. M., and Keffala, V. J. (2005). The relationship between religion/spirituality and physical health, mental health, and pain in a chronic pain population. Pain *116*, 311–321.

Roland, M., and Fairbank, J. (2000). The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. Spine *25*, 3115–3124.

Roland, M., and Morris, R. (1983). A study of the natural history of back pain, part 1: Development of a reliable and sensitive measure of disability in low-back pain. Spine *8*, 141–144.

Severeijns, R., Vlaeyven, J., van den Hout, M., and Weber, W. (2001). Pain ctatstrophising predicts pain intensity, disability and psychological distress independent of the level of physical impairment. Clin J Pain *17*, 165–172.

Snaith, R. P., and Zigmond, A. S. (1994). The hospital anxiety and depression scale manual (Windsor: NFER-Nelson).

Sullivan, M., Bishop, S. R., and Pivik, J. (1995). The Pain Catastrophising Scale: Development and Validation. Psychol Assessment *7*, 524–532.

Sullivan, M. J. L. (2012). The Communal Coping Model of Pain Catastrophising : Clinical and Research Implications. Can Psychol *53*, 32–41.

Sullivan, M. J. L., Adams, H., Rhodenizer, T., and Stanish, W. D. (2006). A Psychosocial Risk Factor – Targeted Intervention for the Prevention of Chronic Pain and Disability Following Whiplash Injury. Phys Ther *86*, 8–18.

Sullivan, M., Thorn, B., Haythornthwaite, J., Keefe, K., Martine, M., Bradley, L., and Lefebvre, J. (2001). Theoretical Perspectives on the relation between catastrophizing and pain. Clin J Pain *17*, 52–64.

Tabachnick, B. G., and Fidell, L. S. (2001). Using multivariate statistics (Boston: Allyn & Bacon).

Turk, D. C., Swanson, K. S., and Tunks, E. R. (2008). Psychological Approaches in the Treatment of Chronic Pain Patients—When Pills, Scalpels, and Needles Are Not Enough. Canadian Journal of Psychiatry *53*.

Turner, J. A., Mancl, L., and Aaron, L. A. (2004). Pain-related catastrophising: a daily process study. Pain *110*, 103–111.

Veehof, M. M., Oskam, M.-J., Schreurs, K. M. G., and Bohlmeijer, E. T. (2011). Acceptance-based interventions for the treatment of chronic pain: A systematic review and meta-analysis. Pain *152*, 533–542.

Vowles, K. E., and McCracken, L. M. (2010). Comparing the role of psychological flexibility and traditional pain management coping strategies in chronic pain treatment outcomes. Behav Res Ther *48*, 141–146.

Vowles, K. E., McCracken, L. M., and Eccleston, C. (2008a). Patient functioning and catastrophizing in chronic pain: The mediating effects of acceptance. Health Psychol *27*, S136–S143.

Vowles, K. E., McCracken, L. M., McLeod, C., and Eccleston, C. (2008b). The Chronic Pain Acceptance Questionnaire: confirmatory factor analysis and identification of patient subgroups. Pain *140*, 284–291.

Vowles, K. E., and McCraken, L. M. (2010). Comparing the influence of psychological flexibility and traditional pain management coping strategies on chronic pain treatment outcomes. Behav Res Ther *48*, 141–146.

Vowles, K. E., Wetherell, J. L., and Sorrell, J. T. (2009). Targeting Acceptance, Mindfulness, and Values-Based Action in Chronic Pain: Findings of Two Preliminary Trials of an Outpatient Group-Based Intervention. Cog Behav Pract *16*, 49–58.

Wetherell, J. L., Afari, N., Rutledge, T., Sorrell, J. T., Stoddard, J. a, Petkus, A. J., Solomon, B. C., Lehman, D. H., Liu, L., Lang, A. J., et al. (2011). A randomized, controlled trial of acceptance and commitment therapy and cognitive-behavioral therapy for chronic pain. Pain *152*, 2098–2107.

Wicksell, R. K., Ahlqvist, J., Bring, A., Melin, L., and Olsson, G. L. (2008). Can exposure and acceptance strategies improve functioning and life satisfaction in people with chronic pain and whiplash-associated disorders (WAD)? A randomized controlled trial. Cog Behav Ther *37*, 169–182.

Wicksell, R. K., Olsson, G. L., and Hayes, S. C. (2010). Psychological flexibility as a mediator of improvement in Acceptance and Commitment Therapy for patients with chronic pain following whiplash. Eur J Pain *14*.

van Wilgen, C. P., van Ittersum, M. W., Kaptein, A. a, and van Wijhe, M. (2008). Illness perceptions in patients with fibromyalgia and their relationship to quality of life and catastrophizing. Arthritis Rheum *58*, 3618–3626.

Woby, S. R., Watson, P. J., Roach, N. K., and Urmston, M. (2004). Are changes in fear-avoidance beliefs , catastrophizing , and appraisals of control , predictive of changes in chronic low back pain and disability ? Eur J Pain *8*, 201–210.

Zigmond, A. S., and Snaith, R. P. (1983). "The hospital anxiety and depression scale". Acta Psychiat Scand, 67, (6), 361 - 370.

Table 1: Descriptive data and comparative tests for all measures

Measure	Current Study Sample (N=150)		Comparative Data			T-test
	Mean	*SD*	N	Mean	*SD*	*p*
Pain severity *(MPQ-SF total)*	18.02	10.05	120	17.33[a]	9.04	ns
Emotional Distress *(HADS total)*	17.20	8.50	296	17.4[b]	8.86	ns
Functional disability *(RDQ total)*	11.88	5.98	35	14.1[c]	5.3	.049
Illness Appraisals (IPQ-R subscales)						
Identity	3.81	3.00	63	6.19[d]	2.40	<.001
Timeline (Acute/chronic)	23.25	4.86	63	23.12[d]	4.41	ns
Consequences	20.67	5.17	63	23.45[d]	3.89	<.001
Emotions	19.18	5.47	63	19.75[d]	4.15	ns
Personal control	18.84	4.42	63	18.42[d]	4.01	ns
Timeline (cyclical)	12.73	4.05	63	12.87[d]	3.89	ns
Treatment control	15.13	3.81	63	14.22[d]	3.36	ns
Illness coherence	15.72	5.64	63	13.37[d]	4.78	<.05
Catastrophising *(PCS total)*	21.71	13.48	70	24.3[e]	11.2	ns
Acceptance *(CPAQ total)*	55.32	20.55	57	53.3[f]	20.5	ns

[a] From Rippentrop et al.,2005; b From Pallant & Bailey, 2005; [c] From Crombez et al, 1999; [d] Derived from Moss-Morris et al., 2002; [e] From Sullivan et al, 2006; [f] From Wetherell et al., 2011

Table 2: Correlations between all mediator variables

	Catastrophizing	Acceptance	Pain Severity	Emotional distress	Physical functioning
Identity	.36*	-.37*	.50*	.34*	.34*
Timeline	.35*	-.32*	.34*	.38*	.40*
Consequences	.58*	-.61*	.47*	.61*	.60*
Emotions	.72*	-.57*	.29*	.66*	.37*
Personal control	-.26	.23	-.07	-.16	-.13
Cyclical	.08	-.03	.02	.02	-.07
Treatment control	-.31*	.24	-.22	-.30*	-.30*
Coherence	-.31*	.17	-.12	-.14	-.04
Catastrophizing	-	-.65*	.42*	.75*	.46*
Acceptance	-.65*	-	-.33*	-.61*	-.62*

Pearson's *r, *p*<.005

Table 3: Direct versus indirect effects in the mediation of pain on outcomes by combined content and context factors

	β	*se*	Statistic	*p*	Adj. R^2	$F_{(10,139)}$	*p*
			Emotional dysfunction				
Total effect	.351	.063	t = 5.59	<.0001	.63	23.75	<.0001
Direct effect	.070	.055	t = 1.287	.200			
Indirect effect	.280	.058	Z = 4.82	<.0001			
			Physical dysfunction				
Total effect	.209	.046	t = 4.58	<.0001	.45	12.06	<.0001
Direct effect	.013	.047	t = .267	.790			
Indirect effect	.196	.041	Z = 4.78	<.0001			

Table 4: Mediation of the content and context variables on the effect of pain on physical function

	Indirect Effects				
	Product of Coefficients			Bootstrapping BCa 95% CI	
	Point Estimate	*SE*	*Z*	Lower	Upper
Catastrophizing	-.001	.025	-.039	-.060	.059
Acceptance	.080	.025	3.144*	.039	.137
Identity	.028	.023	1.236	-.025	.086
Timeline (Acute/chronic)	.016	.016	.995	-.018	.054
Consequences	.077	.028	2.769*	.027	.133
Emotions	-.011	.017	-.637	-.053	.023
Personal control	.000	.003	.011	-.009	.010
Timeline (cyclical)	-.001	.003	-.236	-.019	.006
Treatment control	.011	.010	1.100	-.004	.042
Illness coherence	-.003	.005	-.614	-.028	.005

Note –BCa, bias corrected and accelerated; 10,000 bootstrap samples, *p<.05

Table 5: Mediation of the content and context variables on the effect of pain on emotional distress

	Indirect Effects				
	Product of Coefficients			Bootstrapping BCa 95% CI	
	Point Estimate	*SE*	*Z*	Lower	Upper
Catastrophizing	.158	.041	3.857*	.088	.257
Acceptance	.029	.022	1.335	-.014	.087
Identity	-.010	.027	-.375	-.074	.034
Timeline (Acute/chronic)	-.008	.019	-.419	-.045	.030
Consequences	.051	.031	1.632	-.012	.120
Emotions	.065	.026	2.459*	.022	.131
Personal control	-.001	.004	-.304	-.020	.005
Timeline (cyclical)	-.001	.003	-.227	-.017	.007
Treatment control	.007	.012	.620	-.015	.038
Illness coherence	-.015	.012	-1.252	-.051	.005

Note –BCa, bias corrected and accelerated; 10,000 bootstrap samples, *p<.05